DOCUMENT RESUME

ED 432 170 HE 032 142

AUTHOR	Malcom, Shirley M.; Van Horne, Virginia V.; Gaddy, Catherine D.; George, Yolanda S.
TITLE	Losing Ground: Science and Engineering Graduate Education of Black and Hispanic Americans.
INSTITUTION	American Association for the Advancement of Science, Washington, DC.
SPONS AGENCY	Alfred P. Sloan Foundation, New York, NY.
ISBN	ISBN-0-87168-620-1
PUB DATE	1998-00-00
NOTE	60p.
AVAILABLE FROM	American Association for the Advancement of Science, 1200 New York Avenue, NW, Washington, DC 20005; Tel: 202-326-6670; Fax: 202-371-9849; Web site: http://www.aaas.org
PUB TYPE	Reports - Research (143) -- Tests/Questionnaires (160)
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	*Affirmative Action; Blacks; Case Studies; College Admission; Court Litigation; *Engineering Education; *Enrollment Trends; Graduate Students; *Graduate Study; Higher Education; Hispanic Americans; Racial Differences; *Research Universities; *Science Education; Student Financial Aid

ABSTRACT

This study examined the effects of court challenges to affirmative action policies on the admission of black and Hispanic students to selective science and engineering (S&E) graduate programs. Data were gathered from a sample of 76 major research universities in regard to the application, admission, and enrollment of U.S. citizens and permanent residents by race and by ethnicity for the years 1994, 1995, 1996, and 1997, as well as policies related to the award of financial aid to students. Case studies were conducted at 10 institutions in states that had faced legal challenges to affirmative action. It was found that while the number of bachelor's degrees awarded to black and Hispanic students in S&E programs increased significantly between 1989 and 1995, there was a precipitous one-year drop of over 20 percent in first-year graduate S&E enrollment for black students between 1996 and 1997, and a 16.7 percent drop in enrollment for Hispanic students. Three appendixes contain a copy of the survey instrument, interview protocols, and a list of participating institutions. (Contains 16 references.) (MDM)

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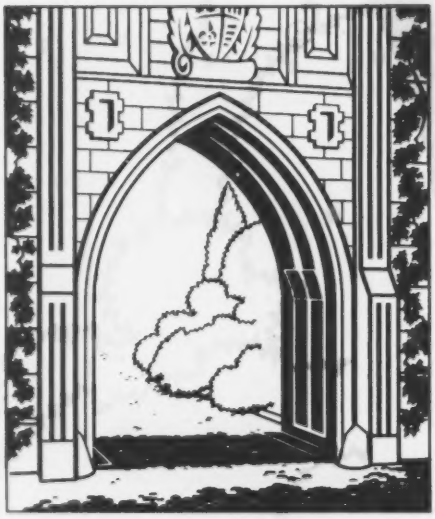
Losing Ground:

Science and Engineering Graduate Education of Black and Hispanic Americans



American Association for the Advancement of Science
with funding from the Alfred P. Sloan Foundation

By
Shirley M. Malcom
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Losing Ground: Science and Engineering Graduate Education of Black and Hispanic Americans

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With funding from the Alfred P. Sloan Foundation

Any interpretations and conclusions are those of the authors and do not necessarily represent the views of the AAAS Board of Directors, the Council of AAAS, the staff or the membership of the association nor the Alfred P. Sloan Foundation.

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ISBN 0-87168-620-1

* Affiliated with the Commission on Professionals in Science and Technology (CPST).

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Founded in 1848, the American Association for the Advancement of Science (AAAS) is the world's largest federation of scientific and engineering societies, with nearly 300 affiliated organizations. In addition, AAAS counts more than 142,000 scientists, engineers, science educators, policy makers, and interested citizens among its individual members, making it the largest general scientific organization in the world.

The Directorate for Education and Human Resources (EHR) Programs seeks to improve education in mathematics, science, and technology; foster equal access to these fields for women, minorities, and people with disabilities; and enhance the public's understanding of all areas of science and technology.

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Acknowledgments

The Directorate for Education and Human Resources Programs of the American Association for the Advancement of Science (AAAS) is grateful to the Alfred P. Sloan Foundation for its generous support of our survey and resulting report on the impact of current and recent changes in the policies and practices with respect to graduate admission and graduate financial aid for underrepresented minorities seeking to pursue Ph.D.'s in science and engineering at research universities.

This report resulted from the combined effort, assistance and cooperation of many people. We are extremely grateful to each person who helped us in the pursuit of information—from those who served as our liaison at site visits to those who gathered the information, to those who pointed us in the right direction and never tired of answering countless questions. In particular we would like to thank the following:

- the staff at the University of California, Office of the President, with a special thanks to Kimberly Hart, James Litrownik, and Ellen Switkes
- the administration, program directors, science and engineering faculty, and students at the participating universities for gathering and reporting the data we sought, as well as for making us feel very welcome on their campuses
- Irelene Ricks and Orlando Taylor of Howard University for their support and for allowing us to share and discuss Howard's data
- our colleagues at the Council of Graduate Schools and the Association of American Universities for their partnership in this study
- Eleanor Babco, Arthur Bienenstock, Sally Bond, Daryl Chubin, William Lester, Iris Weiss, and Luther Williams for their invaluable input
- our Alfred P. Sloan Foundation program officer, Ted Greenwood.

Executive Summary

In 1996 and 1997 a tidal wave of judicial rulings, legislative referenda and editorial opinions opposing affirmative action swept across the landscape of this country. The *Adarand* and *Hopwood* decisions, court challenges to minority focused programs, and in California, the ruling of the Regents of the University of California and Proposition 209* hit the public consciousness, calling into question thirty years of public policy aimed at bringing racial and ethnic minorities and women into the mainstream of American life. Much of the conflict was waged around issues of so-called preferential treatment of minorities in distributing scarce resources—seats in the entering classes of selective programs and/or institutions, and financial support for education.

Documented declines in the enrollment of Black and Hispanic Americans from the entering freshman classes at selective University of California campuses and from law schools and medical schools were front-page news across the nation. In view of the distributed nature of graduate admissions, little was known about the effect of these rulings and referenda on the makeup of the entering classes of prospective scholars and researchers or the faculty of the future.

With support from the American Association for the Advancement of Science (AAAS) and the Alfred P. Sloan Foundation, and with the cooperation of the Association of American Universities (AAU) and the Council of Graduate Schools (CGS), staff of the AAAS undertook a study of the science and engineering (S&E) graduate school population of a sample of 93 major research universities. These universities were selected because of the size of their research enterprise and graduate student population, including underrepresented minority U.S. citizen and permanent resident graduate students, as well as their documented production of Ph.D.'s, including Ph.D.'s awarded to underrepresented minority American students.

Information was requested on the application, admission, and enrollment of U.S. citizens and permanent residents by race and by ethnicity for the years 1994, 1995, 1996, and 1997 as well as on policies related to the award of financial aid to students (as of November 1, 1997).

In 1989, American Indians, Blacks, and Hispanics received 9.8% of all science and engineering bachelor's degrees awarded to U.S. citizens and permanent residents. By 1995 these underrepresented minorities received 13.5% of such degrees awarded to U.S. citizens and permanent residents (Hill, 1997). The underrepresented minority share of S&E bachelor's degrees has increased as the number of such degrees has grown. There has been a stable trend toward increased bachelor's degree production in S&E for underrepresented minorities with increases of over 58.0% for Blacks, 66.5% for Hispanics and 71.7% for American Indians between 1989 and 1995 (Hill, 1997). By contrast, degrees awarded to white, non-Hispanic U.S. citizens and permanent residents have increased by only 10% during the same time period.

While increased enrollment of underrepresented minority American students in graduate education in science and engineering was expected, in light of increased baccalaureate degrees awarded to Black and Hispanic Americans over the previous years, declining enrollments were seen, especially for African Americans. In the study reported herein, a precipitous one-year drop of over 20% was seen in the data collected for all S&E fields and a 19.3% drop in the NSCSM&E (natural sciences, computer sciences, mathematics, and engineering) first-year graduate enrollments of African Americans between 1996 and

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* For information on these court cases, please refer to footnote number two in the Introduction and footnote number six in the Findings section of this paper.

1997 (see Figure A). Overall decline observed in first-year S&E and NSCSM&E graduate enrollment did not approach the magnitude of the decline for African American students.

Hispanic American students also showed a decline between 1996 and 1997 for first-year graduate enrollments in S&E and NSCSM&E fields; following an increase between 1995 and 1996, 1997 enrollment returned to approximately 1995 levels for NSCSM&E fields. The decline for Hispanic American entering graduate students was dramatic for all S&E fields, falling 16.2% between 1996 and 1997 after three consecutive years of gains (see Figure B).

Some of the overall decline, as well as the decline for Black and Hispanic Americans, in first-year graduate S&E enrollment was likely related to students' choosing to move directly into a thriving workforce where there was strong demand for those with bachelor's degrees in S&E fields. But the magnitude of the decline for first-year African American and Hispanic American graduate students between 1996 and 1997 was about twice that seen overall.

Through review of data and research from a variety of sources, the authors considered the following possible explanations for the precipitous drop in first-year S&E enrollments for Black and Hispanic American students from our sample of institutions, including:

- students' positive response to a thriving economy and strong job market, especially for persons with technical skills;
- increased level of debt from undergraduate education leading students to be more hesitant to attend graduate school;
- shift in enrollment from graduate to professional school (especially medical school) enrollment;
- reaction of institutions to the uncertainties of federal support for R&D by shrinking the R&D enterprise and reducing the number of admitted graduate students needing support;
- student movement away from graduate enrollment in response to a perception of declining opportunities for faculty employment;
- shift in enrollment from most selective to less selective graduate institutions not in the sample;
- (re)-introduction and use of the Graduate Record Examination (GRE) as a screen to increase student selectivity, especially in anticipation of a smaller R&D enterprise;
- reaction of students and/or institutions to the heated debate, court challenges and referenda associated with the use of race and ethnicity as factors in the admission of and provision of financial aid to students.

A number of these explanations were discounted based on the findings. Data from the Association of American Medical Colleges (AAMC) do not support the notion that Black and Hispanic American students were diverted from graduate programs to medical schools since medical schools also experienced a precipitous decline in first-year matriculation of underrepresented minorities between 1996 and 1997. Universities in our survey also did not experience decreases in federal funding for R&D between the relevant years.

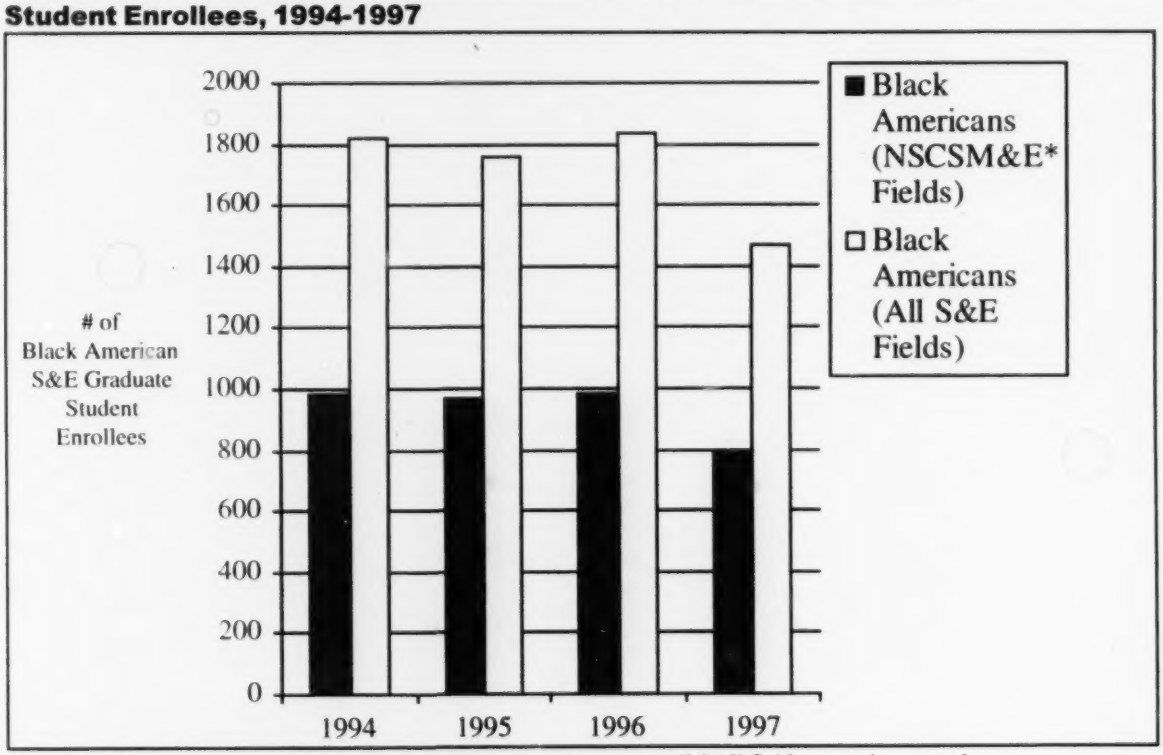
Other possible explanations remain open to research. While it was beyond the scope of this project to query the students who did not apply to or enroll in graduate programs in the surveyed institutions, visits to ten of the universities in the sample revealed a set of contextual issues and common themes that point to the changing climate for affirmative action as a contributing element in the decline of Black and Hispanic American first-year enrollees.

Visits to ten institutions and discussions with administrators, faculty and students lead us to conclude that policy ambivalence wrought by legal challenges (and fear of legal challenges) to programs and financial support targeted to minorities has likely had a chilling effect on the graduate enrollment of underrepresented minority students. The small numbers

of such students—coupled with the decentralized nature of the graduate recruitment, application, admission and enrollment process—means that erosion of the base of underrepresented minority graduate students likely goes undetected in the institution. The shifting policies related to targeted financial support for minority students reinforce the notion of an unwelcoming environment.

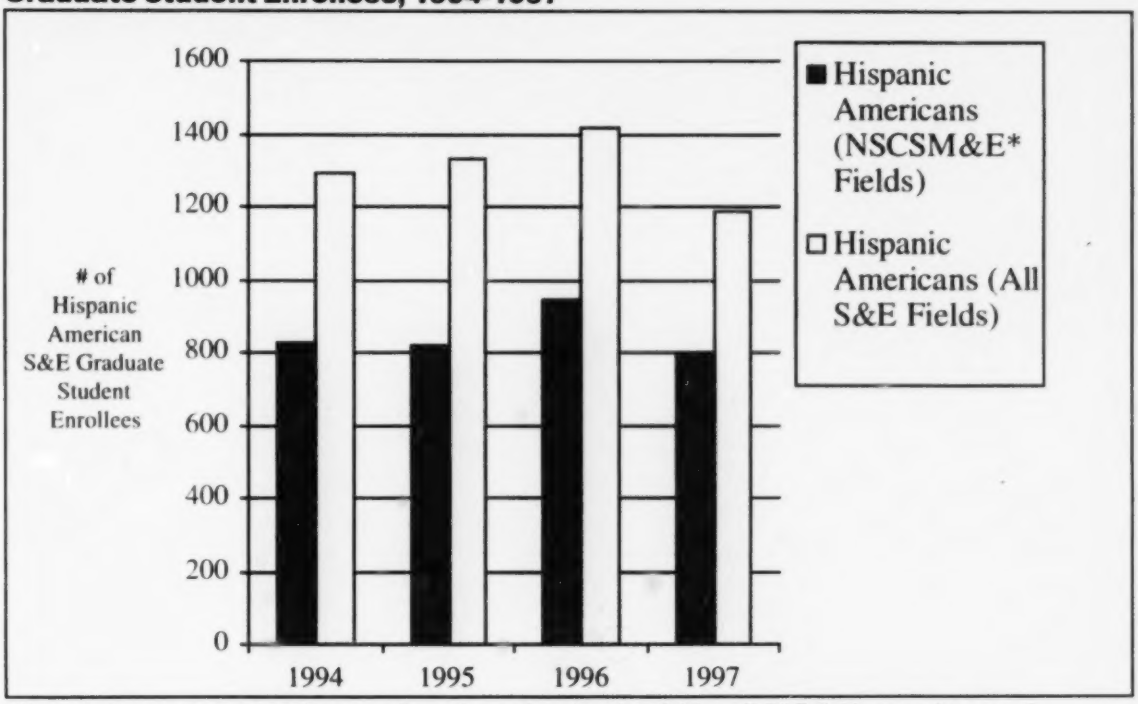
The absence of a supportive environment and the need for minority students to deal with negative incidents are not new. But the shift away from supportive laws and policies sets a new tone. As institutions debate what practices are appropriate and/or legal, underrepresented minority students are continuing to disappear from the pool of entering S&E graduate students. The 21st century science and engineering workforce is being formed now. The prospect that the ethnic and racial composition of that workforce will resemble the diversity of the U.S. population continues to fade.

Figure A. Number of Black American Science & Engineering Graduate Student Enrollees, 1994-1997



*Natural sciences, computer science, mathematics and engineering. All S&E fields comprise natural sciences, computer science, mathematics, engineering, social sciences, and psychology.

Figure B. Number of Hispanic American Science & Engineering Graduate Student Enrollees, 1994-1997



*Natural sciences, computer science, mathematics, and engineering fields. All S&E fields comprise natural sciences, computer science, mathematics, engineering, social sciences, and psychology.

INTRODUCTION

With support from the American Association for the Advancement of Science (AAAS) and the Alfred P. Sloan Foundation, the authors undertook a study of current and recent changes in policies and practices of research universities with respect to graduate admissions and graduate financial aid for underrepresented minorities[1] seeking to pursue Ph.D.'s in science and engineering (S&E). We also sought to determine to what extent the graduate student population is being shaped by the changing climate for affirmative action. How, in particular, are judicial rulings and new legislative referenda and policies affecting admissions, enrollments and financial aid at these institutions?

Do the actions of the 5th Circuit Court (Louisiana, Texas and Mississippi) in *Hopwood v. the State of Texas*[2] and Proposition 209[3] in California change the opportunities for underrepresented minority graduate students in higher education in those states? Recent reports have indicated immediate impact on law school admissions and enrollments as well as effects on medical school admissions and enrollments. Data for the incoming freshman classes of 1997 and 1998 at the various University of California campuses, and Berkeley in particular, suggest dramatic declines in enrollment for African American and Hispanic students (*The Chronicle of Higher Education*, 1998). In order to determine whether similar trends existed for other higher education institutions, 93 of the top recipients of federal funds for R&D, which are also the top enrollees of minority graduate students and producers of minority Ph.D's, were surveyed.

The survey data captured changes in patterns of participation by racial and ethnic groups by field across years, beginning with 1994—a year prior to most of the legal actions and judicial rulings—and extending to the present where legal challenges are underway in a number of

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[1] According to June, 1998 U.S. Bureau of the Census figures, Whites, non-Hispanic are 72.3 percent of the population; Blacks, non-Hispanic are 12.1 percent of the population; Hispanics are 11.2 percent of the population; Asians, non-Hispanic are 3.6 percent of the population; and American Indians, Eskimos and Aleuts, non-Hispanic, are 0.7 percent of the population. In terms of the project scope, the authors chose to focus on the two largest minority groups in the U.S. population.

[2] For many years, higher education institutions relied on the *Regents of the University of California v. Bakke* (438 U.S. 265, 1978) Supreme Court ruling that stated colleges could use race and ethnicity as a factor in admissions decisions but could not designate numbers of spaces for members of specific ethnic and racial groups. Since *Bakke*, a series of lawsuits challenging affirmative action have been filed. In *Hopwood v. State of Texas* [78 F.3d 932 (5th Circuit) (1996)] the court rejected the notion that achieving racial diversity in a student body can ever be a sufficiently compelling reason for racial discrimination. Confining the remedial use of racial preferences to very narrow circumstances, the court reasoned that no state college or university may maintain race-based affirmative action programs; race-based decisions on admissions and financial aid were no longer allowed. In June of 1998, the Texas Attorney General declared that Texas colleges and universities could provide student information to private groups that give scholarships to minority students without running afoul of the *Hopwood* decision.

[3] On November 5, 1996, voters in the State of California approved Proposition 209, also known as the Civil Rights Initiative, (California Constitution Article I, Section 31): "the state shall not discriminate against, or grant preferential treatment to, any individual or group on the basis of race, sex, color, ethnicity, or national origin in the operation of public employment, public education or public contracting." (*The New Yorker*, 1998).

institutions. To complement the statistical survey, staff of the AAAS Directorate for Education and Human Resources Programs visited ten institutions to identify qualitative issues that may affect the quantitative results documented in the surveys. The institutions visited represented a wide geographic range, included both public and private institutions in the states affected by legal and judicial challenges, and focused on the most productive and most prestigious institutions. The sections that follow will outline the methodology used and the findings.

METHODOLOGY

The AAAS/Alfred P. Sloan Foundation funded study was designed to determine the current and recent changes in the policies and practices of research universities with respect to graduate admission and graduate financial aid for U.S. citizen and permanent resident underrepresented minorities (African Americans, Hispanics, and American Indians) seeking to pursue science and engineering Ph.D.s.

AAAS staff developed a list of higher educational institutions to survey by reviewing 1995 National Science Foundation data cross-tabulated by: (1) level of R&D expenditures; (2) number of underrepresented minority S&E U.S. citizen and permanent resident graduate students; and, (3) number of S&E doctorate degrees awarded to underrepresented U.S. citizen and permanent resident minorities. The resulting list of 93 institutions included Research I institutions with both high levels of R&D expenditures and significant graduate training programs.

In mid-June of 1997, a letter signed by officials from the American Association for the Advancement of Science, the Association of American Universities, and the Council of Graduate Schools was sent to the Presidents/Chancellors as well as the Graduate Deans at the selected 93 institutions. The letter mailed to the Presidents/Chancellors explained the purpose of the survey, its importance and how survey information would be used. The Graduate Deans were sent a copy of the letter mailed to their President/Chancellor and also received a separate letter asking that an appropriate point of contact for the survey be designated. By early August, a designated contact had been established at each of the 93 institutions.

In mid-August of 1997, the survey was circulated to the established contact at each of the respective 93 institutions. Respondents were asked to complete and return the survey to AAAS by mid-November, 1997. Data and information gathered were considered confidential; they were not used to directly compare the programs and services at individual institutions. (Please refer to the actual survey in Appendix I for detailed information.) Information on the survey design follows:

- the authors developed the survey instrument and discussed its design with knowledgeable individuals housed within higher education institutions to ensure that respondents would be able to answer the questions posed.
- the survey was separated into six broad fields of science—social sciences, engineering, mathematics, computer science, natural sciences, and psychology. These are the same broad categories used by the Department of Education's Integrated Postsecondary Education Data System (IPEDS).[4]
- the survey was divided into two parts. The first part consisted of six data collection sheets with each sheet corresponding to an S&E broad field. Data on the numbers of U.S. citizen or permanent resident graduate student applications received, offers of acceptance made, and

[4] Since postsecondary institutions [baccalaureate or higher degree granting institutions, two-year award institutions, and less-than-two-year institutions (i.e., institutions whose awards usually result in terminal occupational awards or are creditable toward a formal two-year or higher award)] are required to complete the IPEDS survey, the authors were urged by institutional research staff to replicate the IPEDS format, thus easing the data reporting process of the survey respondents.

numbers of first-time enrollments by individuals into an S&E advanced degree (Master's and/or Doctoral) program were requested for the years 1994-95, 1995-96, 1996-97, and 1997-98 (as of November 1, 1997). Respondents were asked to disaggregate the data by race and sex within race. The second part of the survey consisted of a one page questionnaire pertaining to graduate student financial aid.

In addition to the mail survey, AAAS staff visited ten representative campuses to develop qualitative information regarding graduate admissions, enrollment and completions, and financial aid for underrepresented minority students pursuing advanced degrees in science and engineering. Four criteria were used to select the schools to visit: the three criteria used to select the survey institutions, as well as geographic location (if the school was located in a state that faced legal challenges to affirmative action programs or the potential for such challenges). In order to obtain diverse perspectives and candid input, interviewers met with a wide range of individuals—one-on-one as well as in small focus groups organized by category. For example, interviewers met with different graduate school staff (the Dean, the Outreach Coordinator or Recruiter, the graduate financial aid staff); various science and engineering faculty; and graduate students. With respect to faculty and students, every effort was made to meet with underrepresented minority faculty and students as well as those students who had received some type of fellowship(s). Staff also met with majority students to assess the match of their experiences and views regarding graduate education. The aim was to meet with a representative sample of the S&E graduate faculty and student body. (Please refer to the Interview Protocols in Appendix II for further information.)

Upon completion of the site visits, descriptive case studies were composed and analyzed. In addition, staff conducted data analysis on trends in the numbers of applications, admissions and enrollments for S&E overall by two race/ethnic groups (Blacks and Hispanics).[5]

Initial findings from this analysis were presented at the Council of Graduate Schools' annual meeting in December, 1997 held in Washington, DC. To ensure confidentiality, all data were reported in an aggregated form.

[5]As indicated in the Introduction of this paper, according to June, 1998 U.S. Bureau of the Census figures, Whites, non-Hispanic are 72.3 % of the population; Blacks, non-Hispanic are 12.1 % of the population; Hispanics are 11.2 % of the population; Asians, non Hispanic are 3.6 % of the population; and American Indians, Eskimos and Aleuts, non Hispanic, are 0.7 % of the population. In terms of the project scope, the authors chose to focus on the two largest minority groups in the U.S. population.

FINDINGS

Common Themes

Several common themes from the case studies emerged, as well as challenges for underrepresented students. With respect to financial aid, the challenge for underrepresented minority students is not just in gaining acceptance to a higher education institution, but rather with the financing of their education. A large number of students who have been involved in special programs, e.g., Meyerhoff Scholars at the University of Maryland, Baltimore County, are apprehensive about their future financial security. Since the *Hopwood v. State of Texas* decision, many institutions of higher learning have moved away from using race as a factor in their admissions and financial support processes. In Texas, institutions may not use race as a factor in terms of admission nor use institutional funds for the purposes of minority-targeted awards or fellowships. There is a difference between targeted funds and targeted programs, and several institutions are using a variety of programs and methods to encourage and retain students. Later clarification by the Texas Attorney General has led to the provision of student information to private groups regarding legal means of providing targeted support to minority students, as described in Footnote two on page nine of this report.

Institutions located within regions that have been affected by Proposition 209 or *Hopwood* have had to rely on university lawyers for guidance on allowable practices. AAAS staff were told repeatedly by administrators at institutions outside of those regions that they were in need of more federal guidance in interpreting the implications of court rulings such as *Adarand*.[6] Administrators in state institutions outside of affected districts indicated that they are well-versed on what they can *not* do, but not on what they *can* do. Attorneys for private and public universities seek to prevent possible litigation. In the absence of clear guidelines, a struggle has emerged to find a position that reflects sound education policy and practice yet remains legally defensible. Institutions located in Louisiana and Mississippi are subject to conflicting court rulings, for example, consent decrees that require targeting while *Hopwood* forbids it.

These issues do not solely impact public higher education institutions housed within geographic regions of turmoil. Rather, these issues are affecting private institutions in these regions and both public and private institutions in regions not yet affected by legislation. All of the higher education administrators in the institutions we visited were eager to find out what other institutions were doing and expressed a desire to have clear policy signals. Meanwhile, some administrators mentioned that they are making pre-emptive moves away from targeted support (seeking an alternative to prevent possible legal challenge) even when such support may be coming from private foundations.

These legal ramifications have caused difficulties for the support of underrepresented minority American students, and, in some instances, may have precluded underrepresented minority American students' interest in applying to a number of selective institutions. If an institution is unable to offer financial support to underrepresented American minority students, it cannot remain competitive with those institutions that can and do offer support to these students. To combat this, institutions housed in geographic areas subject to legislative rulings are making efforts to push diversity while heeding both the law and the advice of the state's attorney general. To take advantage of this, institutions in unaffected states are attempting to recruit the best underrepresented minority American students from affected

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[6] In *Adarand Constructors, Inc. v. Peña [(515 U.S. 200 (1995)]*, the U.S. Supreme Court ruled that many federal affirmative action programs be reviewed by the courts using "strict scrutiny" as well as stating the program must be shown to meet a compelling government interest, and must be narrowly tailored to meet that interest.

states. At the same time, many underrepresented American minority students seem to be opting out of the situation altogether (an issue we discuss below).

(A) Financial Aid

One section of the survey focused on the financial support for S&E U.S. citizen and permanent resident graduate students. As the purpose of our survey was to determine if current legislative changes, ballot initiatives, and legal action have had an impact on the numbers of underrepresented minority applicants and enrollees in graduate education in science and engineering, the ten financial support questions focused on targeted (race- or ethnicity-based) support offered by the institution. Questions with respect to general university funding were beyond the scope of this survey.[7]

Slightly more than two-thirds of the returned surveys contained usable financial aid information.[8] General findings are noted in Tables 1 and 2 below:

Table 1. Financial Support: General Findings

• 33 of the 58 survey respondents offer targeted financial support—either by race and/or ethnicity—to S&E graduate students; 24 of the 58 do not offer targeted financial support; one non-respondent. Thirteen of these 24 had not previously offered such support. Eleven institutions, nine from the affected states, have eliminated targeted financial support.
• 15 of the 58 respondents have moved to eliminate race/ethnicity as a consideration/factor in the awarding of graduate student support for S&E students in the past few years; five of the 15 are located in states not affected by legislation. Of the 15 which responded affirmatively to question 2,[9] two currently offer targeted support. Neither of these two institutions (nor three others which answered this question in the affirmative) are located in states affected by court rulings or referenda.
• 16 of the 58 respondents (13 of those answering affirmatively to question 2, two others currently offering targeted support and one not offering targeted support) have developed other measures of disadvantage to consider in the awarding of graduate student support for S&E students. (Please refer to Table 2.)

[7] If the reader is interested in further information on financial support as well as results from data collected in the *Survey of Earned Doctorates*, the authors suggest the following publication: Henderson, P.H., J.E. Clarke, and C. Woods. 1998. *Summary Report 1996: Recipients from United States Universities*. Washington, D.C.: National Academy Press.

[8] Although AAAS received 76 surveys, only 58 of the 76 survey respondents completed the financial support section of the survey. The survey instrument used required "yes or no" responses.

[9] Question two reads as follows: in light of the changing policy climate and debate on affirmative action within the country, has your institution moved to eliminate race as a consideration/factor in the awarding of graduate student support for S&E students in the past few years?

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Table 2. Financial Support: Other Measures of Disadvantage to Consider[10]

• Applicant attended an economically disadvantaged high school or minority institution.
• Applicant is from a disadvantaged urban or rural neighborhood.
• Applicant has a physical or learning disability.
• Applicant is the first person in his/her family to pursue a higher education degree.

Other questions on the financial aid survey sought to determine the extent to which data were available on financial aid in disaggregated forms that would allow one to assess the type of support provided to graduate students by race and/or gender. Half of the respondents indicated that they could provide data in this fashion.

(B) Applications

The survey requested disaggregated data on the numbers of U.S. citizen or permanent resident graduate student applications received, offers of acceptance made, and numbers of first-time enrollments by individuals into an S&E advanced degree program for the years 1994-95, 1995-96, 1996-97, and 1997-98 (as of November 1, 1997). Most institutions surveyed did not meet the statistical criteria demanded for demonstrating change of composition among applications, admissions and enrollees.[11] We have analyzed the data in two fashions: aggregated data from all fields surveyed (natural sciences, computer science, mathematics, engineering, social sciences, and psychology) and aggregated data from natural sciences, computer science, mathematics and engineering (NSCSM&E) only.

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[10] These measures of disadvantage were taken from the fifteen survey respondents who had responded "yes" to the question "has your institution developed other measures of disadvantage to consider in the awarding of graduate student support for S&E students? If yes, what measures of disadvantage does your institution take into consideration?"

[11] The authors analyzed data only from those institutions that were able to provide the following: data for all four years (1994, 1995, 1996, and 1997) in any category, i.e., four years of application data, four years of admissions data, four years of enrollment data; and, data for Black or Hispanic Americans or both. Out of the 93 institutions surveyed, we received 76 responses. Please note the following breakdown for analyses by "all fields" (natural sciences, computer science, mathematics, engineering, social sciences and psychology): applications, 55 usable responses; admissions, 56 usable responses; enrollments, 64 usable responses. With respect to the analyses by NSCSM&E (natural sciences, computer science, mathematics, and engineering): applications, 50 usable responses; admissions, 52 usable responses; enrollments, 60 usable responses. In the NSCSM&E figures, data from three out of the four fields (natural sciences, computer sciences, mathematics, and engineering) were required. The authors separated the data into three categories: increase (change upward of a whole percentage point for at least two of the four years); decrease (change downward of a whole percentage point for at least two of the four years); and no trend (no increase or decrease, or data reported flat for three years and up and down for one; data reported in an upward and downward fashion so that no conclusions could be drawn).

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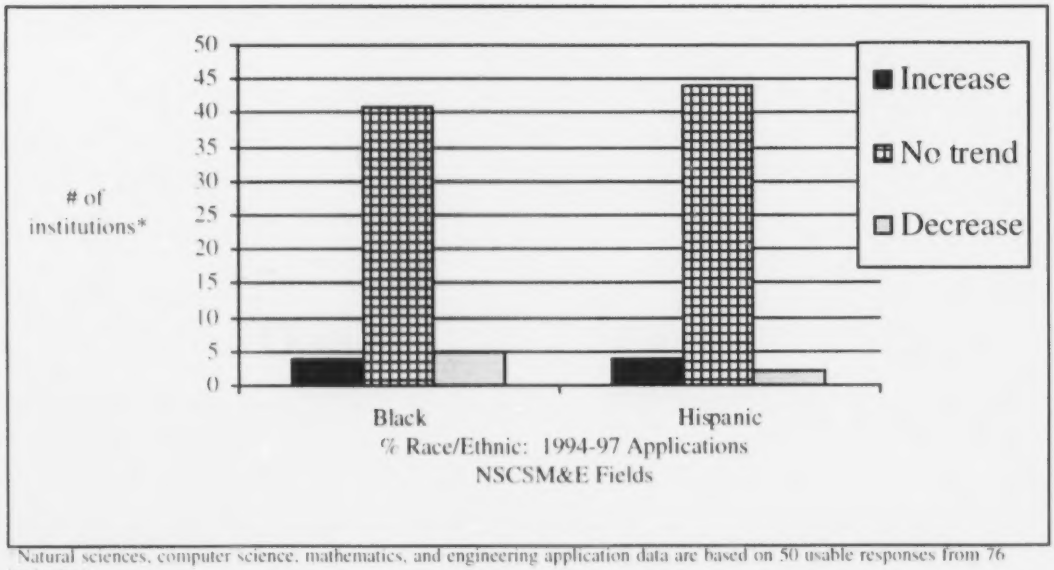
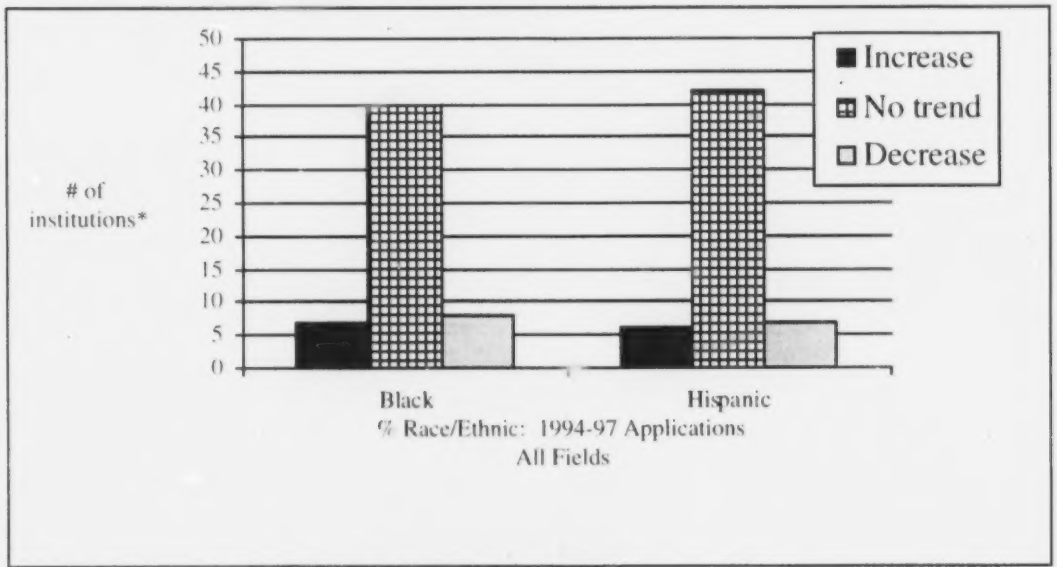
Figure 1. Number of Institutions Showing Increases, No Trend, or Decreases in First-Year S&E Graduate School Applications for U.S. Citizen and Permanent Resident Black and Hispanic Students, 1994-97 (NSCSM&E Fields)*



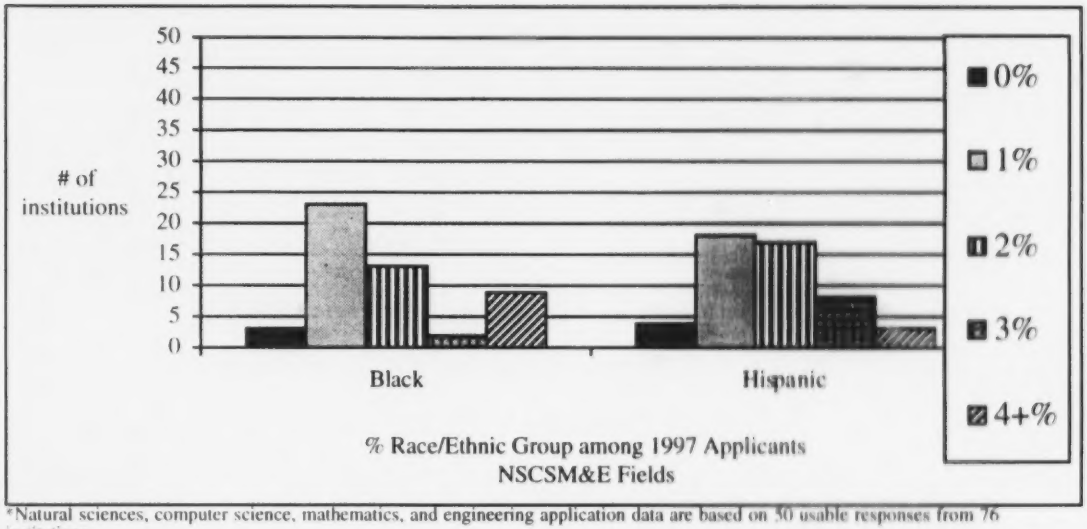
*Natural sciences, computer science, mathematics, and engineering application data are based on 50 usable responses from 76 institutions.

Figure 2. Number of Institutions Showing Increases, No Trend, or Decreases in First-Year S&E Graduate School Applications for U.S. Citizen and Permanent Resident Black and Hispanic Students, 1994-1997 (All Fields)*



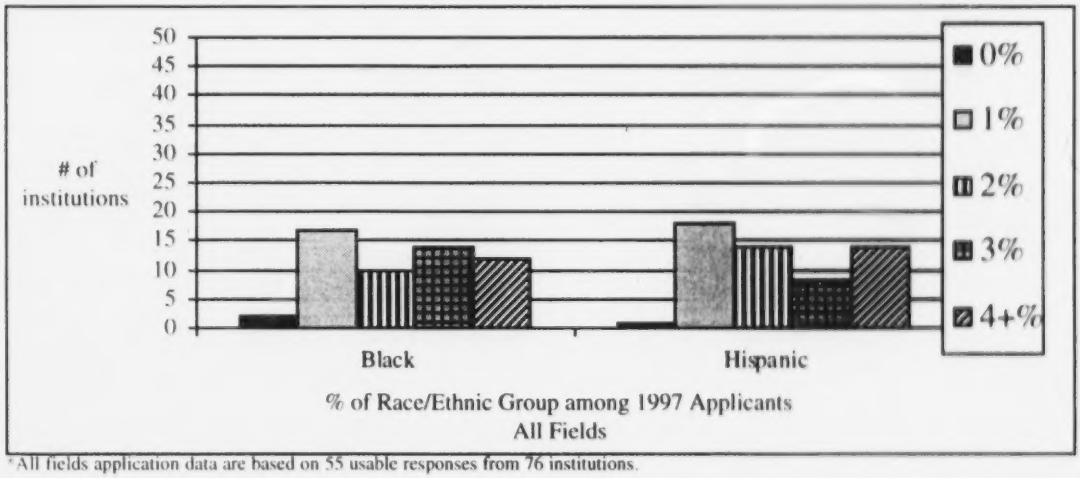
*All fields application data are based on 55 usable responses from 76 institutions.

Figure 3. Number of Institutions with 0 to 4+ Percentage of Blacks and Hispanics in the 1997 U.S. Citizen and Permanent Resident S&E Graduate Student Applicant Pool (NSCSM&E Fields)*



*Natural sciences, computer science, mathematics, and engineering application data are based on 50 usable responses from 76 institutions.

Figure 4. Number of Institutions with 0 to 4+ Percentage of Blacks and Hispanics in the 1997 U.S. Citizen and Permanent Resident S&E Graduate Student Applicant Pool (All Fields)*



*All fields application data are based on 55 usable responses from 76 institutions.

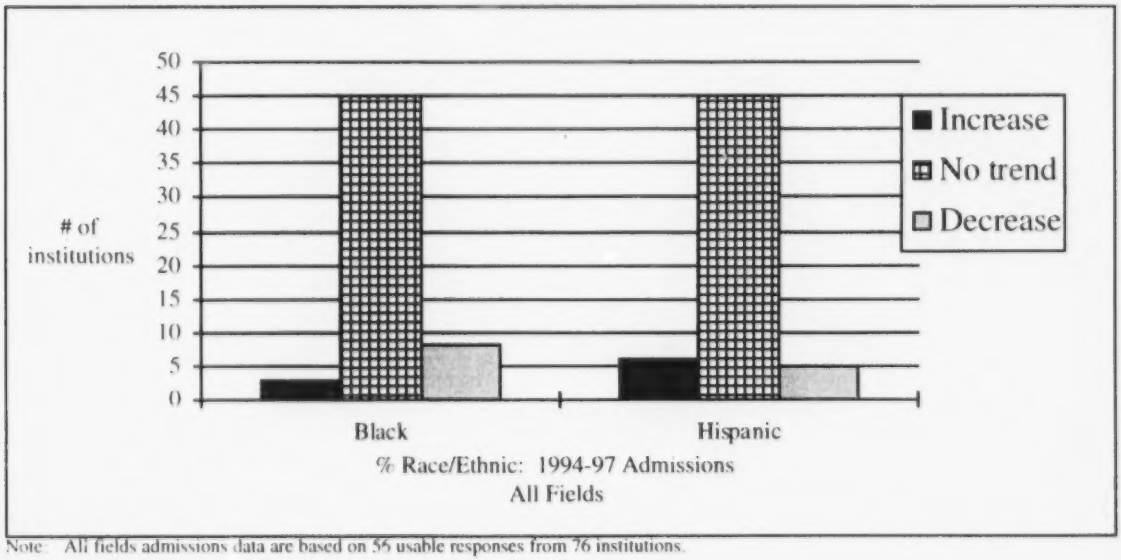
No trend was the most common finding from the graduate application analysis for the years 1994-1997 (Figures 1 and 2). Data from all science and engineering fields indicated 40 institutions as having no trend among Black Americans and 42 institutions having no trend among Hispanic Americans; the NSCSM&E data analysis showed 41 institutions as having no trend among Black Americans and 44 institutions having no trend among Hispanic Americans. The survey revealed very low percentages of African Americans and Hispanic Americans in the 1997 pool of applicants (Figures 3 and 4). With respect to the all fields analysis, in 43 (or 78%) of the institutions that responded to the survey, African Americans

are less than four percent of the 1997 graduate applicant pool; in 41 of the institutions that responded to the survey, Hispanic Americans are less than four percent of the 1997 graduate applicant pool. Results are equally low in the NSCSM&E area. In 41 (or nearly 75%) of the institutions surveyed, African Americans are less than four percent of the graduate applicant pool; in 47 of the institutions surveyed, Hispanic Americans are less than four percent of the 1997 graduate applicant pool. Since the same students are applying to many institutions, application data can paint a deceptively positive picture. Given the small numbers of students, additional years of data are required in order to draw further conclusions from the set of institutions now contained in the grouping *no trend*.

(C) Admissions

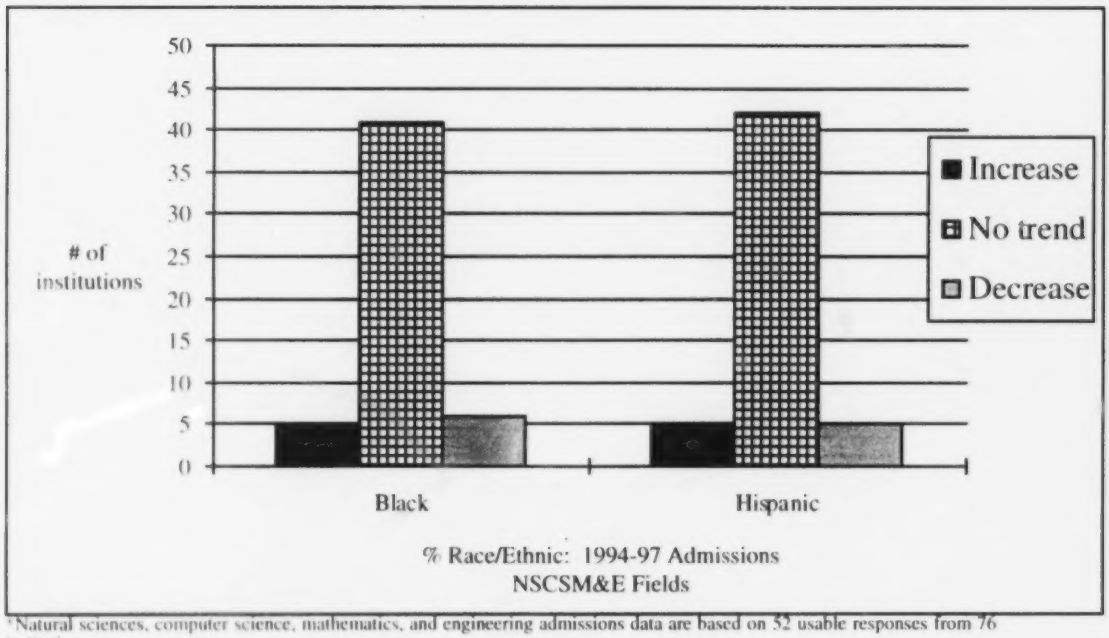
For the years 1994-1997, there is as yet no clear pattern on admissions of underrepresented minorities to graduate programs, since after analyzing all available data, *no trend* was also the predominant result. [In the analysis of all fields, 45 institutions showed no trend in graduate admissions for Black and Hispanic Americans (Figure 5); in the NSCSM&E analysis, 41 institutions showed no trend in graduate admissions for Black Americans and 42 institutions showed no trend in graduate admissions for Hispanic Americans (Figure 6)]. Black and Hispanic American students form a very small component of the admissions pool for most of the universities. As indicated in Figure 7, with respect to all fields, in 42 of the institutions that responded to the survey, African Americans make up less than four percent of the 1997 graduate admissions pool; Hispanic Americans are less than four percent of the 1997 graduate admissions pool in 43 of the institutions that responded. In terms of NSCSM&E, African Americans make up less than four percent of the 1997 graduate admissions pool at 43 of the institutions and Hispanic Americans make up less than four percent of the 1997 graduate admissions pool at 47 of the institutions (Figure 8).

Figure 5. Number of Institutions Showing Increases, No Trend, or Decreases in First-Year S&E Graduate School Admissions for U.S. Citizen and Permanent Resident Black and Hispanic American Students, 1994-1997 (All Fields)*



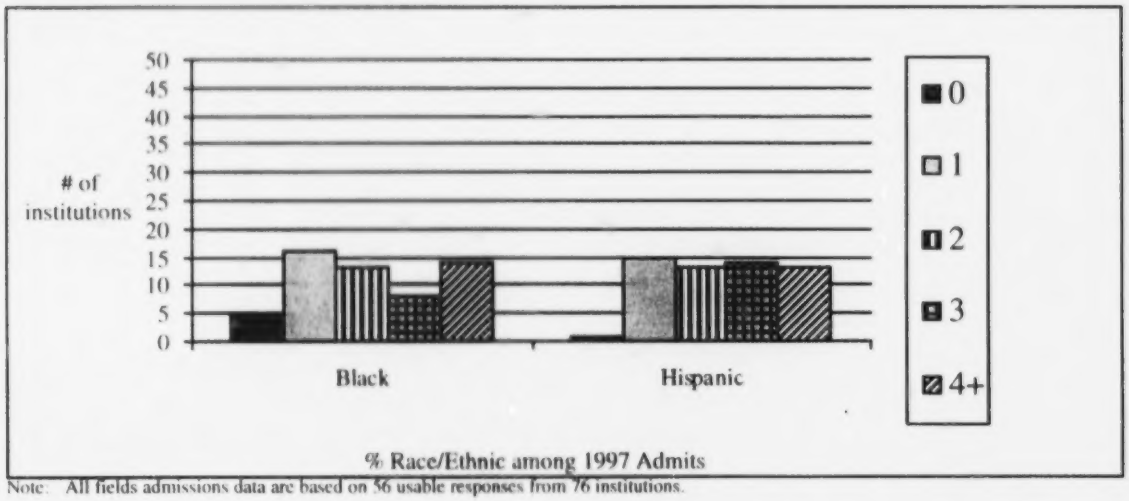
Note: All fields admissions data are based on 56 usable responses from 76 institutions.

Figure 6. Number of Institutions Showing Increases, No Trend, or Decreases in First-Year S&E Graduate School Admissions for U.S. Citizen and Permanent Resident Black and Hispanic Americans Students, 1994-1997 (NSCSM&E Fields)*



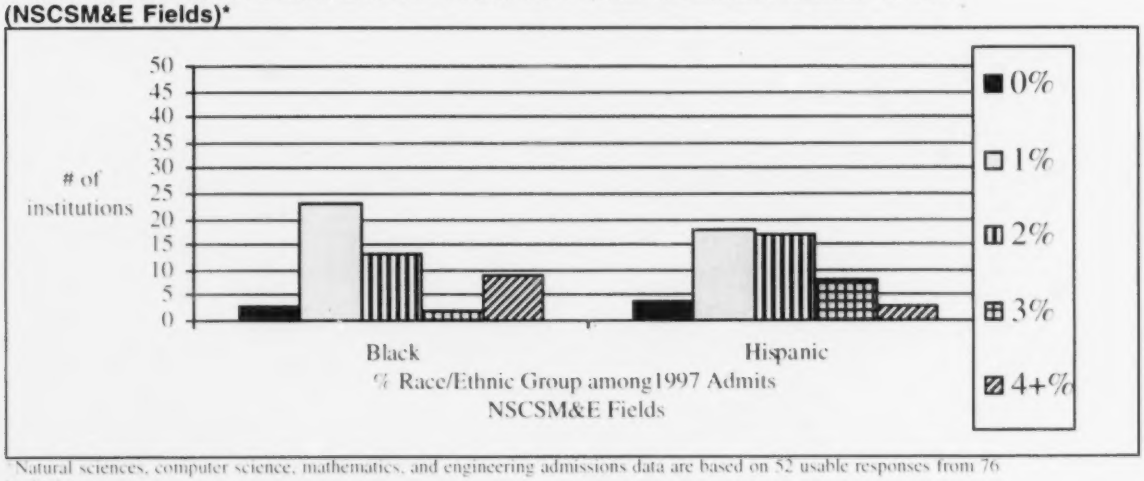
*Natural sciences, computer science, mathematics, and engineering admissions data are based on 52 usable responses from 76 institutions.

Figure 7. Number of Institutions with 0 to 4+ Percentage of Black and Hispanic U.S. Citizen and Permanent Residents in S&E 1997 First-Year Graduate School Admits (All Fields)*



Note: All fields admissions data are based on 56 usable responses from 76 institutions.

Figure 8. Number of Institutions with 0 to 4+ Percentage of Black and Hispanic U.S. Citizen and Permanent Residents S&E First-Year Graduate School Admits in 1997 (NSCSM&E Fields)*

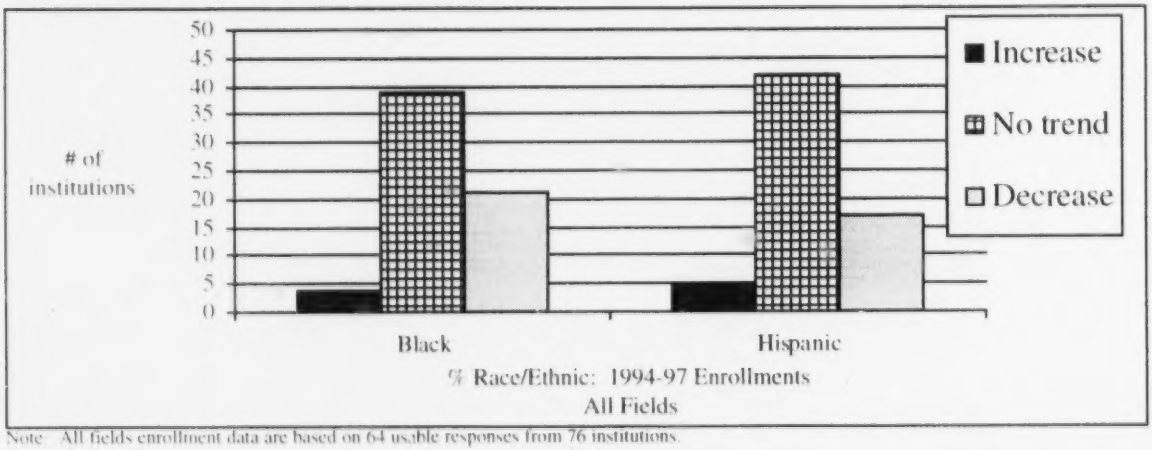


*Natural sciences, computer science, mathematics, and engineering admissions data are based on 52 usable responses from 76 institutions.

(D) Enrollments

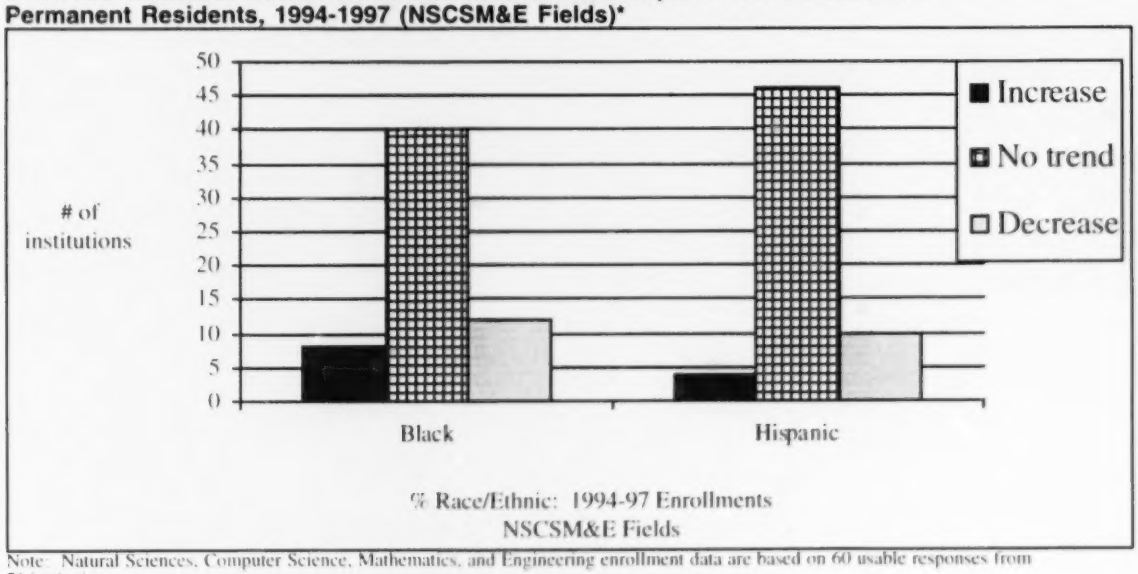
Due to the fact that underrepresented minority students, like all students, apply to many institutions, the real effect of policies and practices can only be seen when the students actually select a single institution and enroll. Of instititutions showing trends, for both Black American and Hispanic American students many more institutions show decreasing graduate school enrollments in S&E than show increasing enrollments (Figures 9 and 10). In 1997, underrepresented minority students had a small presence in the entering graduate student population, representing only a few percent of the enrolling group (Figures 11 and 12). In addition Black Americans and Hispanic Americans are likely to be a larger component of the social and behavioral sciences than of the natural sciences and engineering student populations.

Figure 9. Number of Institutions Showing Increases, No Trend, or Decreases in S&E First-Year Graduate School Enrollment of Black and Hispanic U.S. Citizens and Permanent Residents, 1994-1997 (All Fields)*



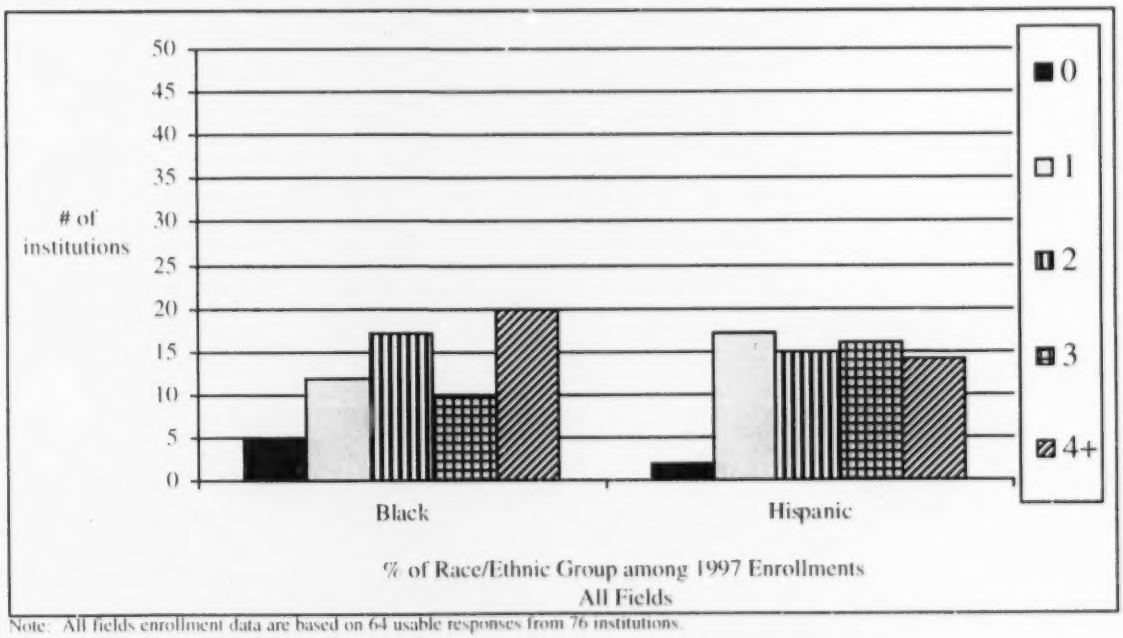
Note: All fields enrollment data are based on 64 usable responses from 76 institutions.

Figure 10. Number of Institutions Showing Increases, No Trend, or Decreases in S&E First-Year Graduate School Enrollment of Black and Hispanic U.S. Citizens and Permanent Residents, 1994-1997 (NSCSM&E Fields)*



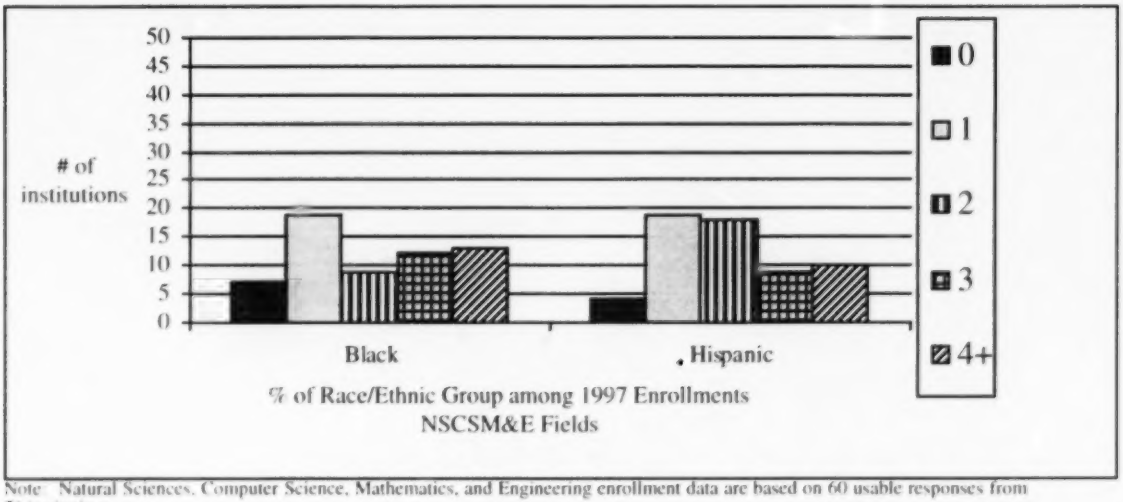
Note: Natural Sciences, Computer Science, Mathematics, and Engineering enrollment data are based on 60 usable responses from 76 institutions.

Figure 11. Number of Institutions with 0 to 4+ Percentage of Black and Hispanic U.S. Citizen and Permanent Resident S&E First-Year Graduate School Enrollees in 1997 (All Fields)*



Note: All fields enrollment data are based on 64 usable responses from 76 institutions.

Figure 12. Number of Institutions with 0 to 4+ Percentage of Black and Hispanic U.S. Citizen and Permanent Resident S&E First-Year Graduate School Enrollees in 1997 (NSCSM&E Fields)*



Note: Natural Sciences, Computer Science, Mathematics, and Engineering enrollment data are based on 60 usable responses from 76 institutions.

Further analysis was undertaken on data from 21 institutions that showed decreasing enrollment of African American and Hispanic American S&E graduate students from 1994 to 1997. These institutions provided data in such a way as to allow direct comparisons by race and by field for first-year graduate school enrollment in 1994 and 1997 (Table 3). Of note, these 21 institutions cover a broad spectrum, from large public universities to selective private institutions. Data were aggregated across the institutions. For example, there was a 14.5% overall decrease in total S&E graduate enrollments; a 37.4% decrease in African American first-year graduate enrollments; and, a 13.4% decrease in Hispanic American first-year graduate enrollments. The African American decline for first-year graduate enrollment in engineering between 1994 and 1997 figures was 48.1%; for Hispanic Americans, the decline in engineering was 26%. The overall decrease in engineering first-year graduate enrollment was 21.1%. In natural sciences, African Americans experienced a first-year graduate enrollment decline of 35.6%; Hispanic Americans experienced a decline of only one percent. The overall decrease in natural sciences enrollment was 12.7%. In mathematics and computer science there was a 62.5% decline in first-year graduate enrollments for African Americans; Hispanic Americans experienced a decline of 28.6% and the overall decline was 22.7%.

Table 3. First-Year Graduate Enrollment Changes from 1994 to 1997—a Look at 21 Institutions

Field	94 black	97 black	% change	94 hisp	97 hisp	% change	94 Overall	97 Overall	% change
Social	172	124	27.9%	97	97	0.0%	3009	2806	6.7%
Engineering	104	54	48.1%	104	77	26.0%	3455	2725	21.1%
Math	14	3	78.6%	11	9	18.2%	465	334	28.2%
Computer Sci	34	15	55.9%	17	11	35.3%	809	651	19.5%
Natural Sci	118	76	35.6%	99	98	1.0%	3865	3373	12.7%
Psychology	28	22	21.4%	31	19	38.7%	417	388	7.0%
Total	**470**	**294**	**37.4%**	**359**	**311**	**13.4%**	**12020**	**10277**	**14.5%**

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Table 4 below documents U.S. citizen and permanent resident Ph.D. degree production as well as a breakdown of the Black and Hispanic Americans' share of S&E Ph.D.'s by field in the years 1994-1996. When compared with Table 3, the percentages reflect levels at or below what is needed to achieve "maintenance" of underrepresented minority doctorates for most fields for a set of institutions initially selected for high levels of underrepresented minority Ph.D. program enrollment and production.

Table 4. Percentage of Ph.D.'s Awarded to Black and Hispanic Americans by Broad Field, 1994-1996

S&E Field	94 % Black	94 % Hisp	94 Total US Citizens & Perm	95 % Black	95 % Hisp	95 Total US Citizens & Perm	96 % Black	96 % Hisp	Total US Citizens & Perm
Social Sciences	5	3	2692	6	3	2721	5	3	2793
Engineering	2	2	3053	2	2	3342	2	3	3383
Mathematics	2	2	657	1	2	771	1	2	646
Computer Science	2	1	543	2	1	616	2	3	513
Natural Sciences	2	3	8106	2	3	8362	2	3	8067
Psychology	4	4	3136	5	5	3184	5	15	3226
TOTAL S&E	3	3	18187	3	3	18996	3	3	18628
% US Population	12.5	10.1		—	—		12.6	10.7	

Source: National Science Foundation (http://www.nsf.gov/sbe/srs AND http://www.census.gov/population/estimates)

Howard University, the only Research Level I Historically Black University, makes a disproportionate contribution to the overall African American enrollment represented by our pool of institutions, especially in the natural and social sciences. (Permission was received from Dean Taylor of Howard Univerisity to identify this particular institution.) Of the nearly 1,500 African Americans enrolled in the science and engineering fields in the 76 institutions that responded to the survey, 28% of those in the natural sciences and 33% of those in the social sciences were contributed by Howard University. Please refer to Tables 5 and 6 for further details.

Table 5. Number of Black and Hispanic American S&E 1997 Graduate School Enrollees, without Howard University in the Calculation

Field	1997 Black Americans	1997 Hispanic Americans	1997 Total
Social Sciences	351	307	8368
Engineering	219	327	11018
Math	49	38	1612
Computer Science	48	29	2695
Natural Sciences	329	402	12202
Pyschology	129	83	2049
TOTAL	1125	1186	37944

Enrollment data from 75 institutions.

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Table 6. Number of Black American S&E 1997 First-Year Graduate School Enrollees, with Howard University in the Calculation

Field	1997 Black	1997 Hispanic Americans	1997 Total
Social Sciences	524	308	8585
Engineering	230	327	11039
Math	55	38	1623
Computer Science	50	29	2701
Natural Sciences	459	403	12380
Psychology	148	84	2072
TOTAL	1466	1189	38400

Enrollment data from 76 institutions.

In an earlier discussion on enrollment in Section D of this paper, the authors examined enrollment data using the institution as the unit of analysis. With *no trend* as the predominant response, we elected to aggregate enrollment data from the 76 survey respondents (60-64 usable responses) to determine whether any trend could be detected when small changes were accumulated across institutions. In addition, we wished to determine the timing or fields of any changes that might point to causal factors.

Table 7. First-Year Graduate Enrollment Data for All Institutions by Race and by Field, 1994-1997

	94 Black	94 Hisp	94 Total	95 Black	95 Hisp	95 Total	96 Black	96 Hisp	96 Total	97 Black	97 Hisp	97 Total
Engineering	312	347	12751	335	343	12507	294	405	12819	230	327	11039
Math	76	50	2096	58	37	1956	54	38	1628	55	38	1623
Computer Science	66	43	2561	74	41	2380	72	40	2959	50	29	2701
Natural Science	528	387	13619	500	398	13965	565	461	12691	459	402	12380
subtotal	**982**	**827**	**31027**	**967**	**819**	**30808**	**985**	**944**	**30097**	**794**	**796**	**27743**
Social Sciences	678	343	10637	637	403	10281	638	363	10136	524	307	8585
Psychology	163	123	2270	150	112	1920	212	108	2117	148	83	2072
Total	**1823**	**1293**	**43934**	**1754**	**1334**	**43009**	**1835**	**1415**	**42350**	**1466**	**1186**	**38400**

*Total refers to total number of first-year graduate students.

A decline of 19.4% in NSCSM&E fields and over 20% in all S&E fields was seen for African American first-year graduate student enrollees between 1996 and 1997. In previous years the variability in first-year graduate enrollment ranged from two to three percent between years. With respect to Hispanic American graduate student enrollees in NSCSM&E fields, these numbers have shown more volatility. Nearly flat first-year graduate school enrollments in 1994 and 1995 were followed by a significant increase between 1995 and 1996 and a decline of about the same magnitude between 1996 and 1997 (close to a 15% increase in 1995-96; close to a 16% decrease in 1996-97). By contrast, three years of increased first-year enrollments for all S&E fields for Hispanic Americans were followed by a 16.2% decrease between 1996 and 1997, mirroring the abrupt drop seen for African Americans in all fields as well as in NSCSM&E fields.

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DISCUSSION

The process of getting any student into graduate education in the fields of S&E is one of proactive choosing on the part of both the student and the institution or department. The student makes the decision of whether or not to attend graduate school and pursue the Ph.D. Often, someone will suggest—but in every case—someone must support, the decision. Black and Hispanic American students' decisions may be complicated by a lack of role models, lack of resources, and lower expectations on the part of many faculty, since the faculty may also have limited exposure to minority role models as colleagues. Essentially, there are a number of decision pathways students and faculty must travel. For example, the student must decide where to apply. The student may use criteria such as proximity to their home, cost of the institution, size and offer of financial assistance, climate of the institution, presence of friends in the institution, recruitment by a particular faculty member, and/or the reputation of the department and/or institution. The faculty must choose whether to accept a student with weaker or stronger GRE scores, more or less experience, one who can immediately support their research mission, or a student who may need a significant amount of mentoring.

Many Black and Hispanic American students need financial assistance and cannot consider pursuing graduate education without it. Money is a necessary but not sufficient condition for S&E graduate education. The student must also have an environment of support and specific disciplinary connection and mentoring.

On the issue of providing financial aid for minority students, we have identified four distinct groups of institutions by their approaches:

1. status quo - institutions that have retained policies of either offering or not offering targeted support;
2. responders - institutions that once offered targeted support and that no longer do so because of judicial rulings or legislative referenda;
3. anticipators - institutions that offer targeted financial support but are developing surrogate, non-race based criteria;
4. pre-emptors - institutions that have offered targeted support in the past, but no longer do so despite being unaffected by legislation or judicial rulings.

While only two institutions appear in the last category of pre-emptors, their presence may represent the leading edge of a movement to dismantle strategies that include race or ethnicity as a factor in spite of the fact that (except for the 5th Circuit) *Bakke* (see Footnote two) is still the law of the land.

The graduate S&E enrollment figures for the institutions in our sample are not increasing, despite the fact that:

- African American and Hispanic students are earning more S&E bachelor's degrees than ever (Hill, 1997); and
- the institutions were selected for study because of their underrepresented minority graduate student enrollment, Ph.D. production of underrepresented minority students, and research resources.

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It was not known whether that segment of these increased numbers of Black and Hispanic American S&E bachelor's degree recipients who would have been bound for post baccalaureate study have shifted to less selective graduate programs not represented in our sample or whether the anti-affirmative action movement, coupled with a thriving economy, have simply moved such students to opt out of graduate education in science and engineering altogether.

The institutions that showed decreasing enrollment of Black and Hispanic American students included several that were visited by staff. A number of contextual factors were identified during those visits that may be related to the declines that were seen:

- greater emphasis on foreign graduate student recruitment;
- lukewarm attention to minority recruitment and retention;
- changes in policy to emphasize GRE scores in graduate admissions;
- lack of focused institutional effort (no special office concerned with tracking and/or retention);
- decentralization of minority recruitment efforts; and/or
- no express policies to encourage faculty commitment to minority graduate education.

Unfortunately those institutions showing declining enrollment included some of the most selective and prestigious institutions from which the leadership of the science and engineering community is often drawn. Comparing 1994 and 1997 first-year graduate school enrollments[12] in the twenty-one institutions showing a decrease in enrollment (see page 22) for natural sciences, computer science, mathematics and engineering (NSCSM&E), we find a 19.1% decline between the two years for African Americans and a 3.6% decrease for Hispanic Americans. Overall first-year graduate school enrollment of NSCSM&E fields declined by 10.5% between the comparison years for our survey institutions. Hispanic Americans experienced one third of the overall decline in first-year graduate school enrollment while African Americans experienced nearly twice the overall decline in first-year graduate school enrollment in the fields of natural sciences, computer science, mathematics and engineering.

There are any number of possible explanations for the smaller decline in graduate enrollment among Hispanic Americans. Hispanic Americans are composed of a number of different subgroups, including Puerto Ricans, Mexican Americans, Cubans, and various Central and South American origin groups not all of which are disadvantaged. Institutions on the Island of Puerto Rico have contributed disproportionately to bachelor's degree production. In 1995 Puerto Rican institutions awarded 27.1% of engineering, 38.9% of physical sciences, 19.7% of computer science and 26.3% of biological sciences' bachelor's degrees conferred on Hispanics; Puerto Ricans comprise 12% of the U.S. Hispanic American population. In addition, the University of Puerto Rico far outranks all other institutions as the baccalaureate origin of Hispanics receiving the Ph.D. in S&E fields. Programs have been in place in Puerto Rico to encourage and support participation in graduate education—especially in the natural sciences and engineering—since the 1980's. Perhaps Puerto Rican institutions provide a *buffer zone* from the anti-affirmative action rulings and rhetoric that affect the mainland. In addition, the aggressive

[12] The years 1994 and 1997 were deliberately selected as comparison years for two reasons. First, the 1994 data are pre-*Adarand*; the 1997 figures are post-*Adarand*. Second, the authors wanted to account for a natural variation of the first-year enrollment figures, allowing for a range of two-to-five percent variability that can occur between years.

intervention of Hispanic-serving institutions and Hispanic professional organizations may also play a role in the rest of the U.S., especially in those states with concentrated populations of Hispanics.

In spite of the modest decline of Hispanic Americans, the number of Hispanic Americans enrolled in graduate education is still very small and the increased bachelor's degrees did not produce increased graduate enrollment. In addition, translating graduate enrollments into graduate degrees will require vigilant retention and mentoring efforts.

In the same way that institutions on the Island of Puerto Rico play a disproportionate role in the award of bachelor's NSCSM&E degrees to Hispanics, Historically Black Colleges and Universities (HBCU's) contribute disproportionately to the earned bachelors degrees conferred upon African Americans. (Hill, 1997). In 1995, HBCU's awarded 28.0% of engineering, 45.6% of physical science, 46.8% of mathematical science, 38.7% of computer science, and 42.0% of biological science bachelor's degrees to African Americans; they also awarded a significant portion of degrees in the social (25.2%) and behavioral sciences (24.9%). Their contributions in the natural sciences, computer sciences and mathematics are far and above what is expected based on the proportion of all African American undergraduate students that they enroll. As indicated earlier, 1997 NSF data show an increase in S&E baccalaureate degrees awarded to African Americans between 1989 and 1995. It is not clear whether these increases can be sustained in light of recent findings from the Southern Education Foundation which point to declining first-year enrollment of African American undergraduates in the southeast, the location of the majority of HBCU's (Washington Post, 1998).

The authors initially looked at 1994 and 1997 as comparison years (pre- and post-*Adarand*) and found a net decline of over 19% in the first-year graduate school enrollment of African Americans in NSCSM&E fields in the institutions in our survey. Further analysis revealed that all of the decrease occurred between 1996 and 1997. When data were examined within an institution based on the statistical measure required by the authors (see Footnote 11), most institutions showed no trend in first-year graduate school enrollment changes between the years 1994 and 1997 inclusive for African Americans.[11] Examining first-year graduate school enrollment figures aggregated across institutions we are able to see a significant one year decline of nearly 200 new first-year graduate school enrollees between 1996 and 1997 for African Americans. These years include the time frame when *Hopwood*, the Regent's ruling and *Adarand* appeared on the public policy agenda.

Hispanic Americans demonstrated increased first-year graduate school enrollment between 1994 and 1995 with a large jump of some 15% in the NSCSM&E fields in 1996. This was followed, however, by a drop between 1996 and 1997 of the same magnitude. It is difficult to draw conclusions about the first-year graduate school enrollment data for NSCSM&E fields

[11] For the analysis of first-year graduate school enrollment data by year, the authors analyzed the yearly first-year graduate school enrollment data for each S&E field surveyed. The authors analyzed data from institutions that could provide data for three categories: Blacks, Hispanics and Totals in a given year. Data from four out of the six fields (natural sciences, computer science, mathematics, engineering, social sciences and psychology) were required in order for an institution to be included in the *total* count in any of the three categories—Black, Hispanic, and Total. Out of 76 respondents, 64 institutions provided usable data. Please refer to Footnote number 10 in the Findings section for additional information.

given the instability of the trend (15 % increase in 1996; almost a 16% decrease in 1997). On the other hand, after steady increases for all S&E fields from 1994 through 1996, there is a dramatic decrease of 16.2% between 1996 and 1997 for first-year Hispanic American graduate school enrollments.

For African Americans the message is much clearer. After NSCSM&E variation of around 2% for the years 1994-1996, first-year graduate school enrollees declined by over 19% in 1997 for the institutions in our survey. For all science and engineering fields, variations of three to four percent were seen for African Americans between 1994 and 1996; the first-year graduate school enrollees declined by over 20% in 1997. Why were such precipitous drops seen for African Americans and Hispanic Americans between 1996 and 1997 in S&E first-year graduate enrollment? Several interrelated possibilities are explored below.

(A) Diversion of Students into Other Fields of Study

While there is no single organized national effort to increase minority natural sciences Ph.D.'s, there has been a systematic effort to increase minority medical school enrollment coordinated through the Association of American Medical College's (AAMC) Project 3000 by 2000. Historically, African Americans have demonstrated strong interest in medicine as compared with graduate education in the sciences.

Since African American NSCSM&E bachelor's degree recipients are also likely to seek entry into medical school, statistics on medical school matriculants were also examined to determine if these students selected medical school over graduate school in 1997. Instead of seeing African American students diverted from graduate to medical programs, the same pattern of declining enrollments was observed for medical school. According to the Association of American Medical College's (AAMC) Project 3000 by 2000, "underrepresented minority matriculants peaked at 2,014 in 1994, stayed about the same in 1995, then fell to 1,906 in 1996 and then 1,770 in 1997. California and the Hopwood states have accounted for most of the decrease. Underrepresented minority matriculants to California medical schools are down 39% since 1993. In Texas, underrepresented minority matriculants fell 25% between 1996 and 1997 and by more than 30% since 1995. Medical schools in California and the Hopwood states accounted for 82% of the decrease in underrepresented minority matriculants between 1996 and 1997."[14] Medical school enrollment patterns do not support a "student diversion" hypothesis that might account for the loss of African American and Hispanic American students from S&E graduate programs.

(B) Movement of Students into the Job Market

Among the choices available to students completing bachelor's degrees in NSCSM&E fields is the option of directly entering the job market. Market demand for the type of analytic skills such students bring to the workplace, coupled with industry's more aggressive commitment to affirmative action, would provide a powerful "pull" into the labor force.

Yet a small but significant number of students each year choose to ignore the pull of the market in favor of further study. It is not clear whether the graduate study option is as strong for

[14] Timothy Ready, Association of American Medical Colleges, personal communication, August 10, 1998.

African American students. Whereas many industries have been clear about their continued commitment to affirmative action, many academic institutions have been equally clear about their ambivalence. A number of faculty, discouraged by their own experiences in obtaining research grants, have openly expressed their frustration with a research career, without providing a balancing glimpse of the joys and rewards. In addition, the stark disparity between the financial support provided to graduate students and the salaries for these fields available in the workforce, increases the opportunity costs, especially since such students are likely to leave school with considerable debt burden.

Data are not available to us to determine whether the students are choosing directly to enter the workforce, and, if so, if the lure of the job or the less attractive option of graduate school is the reason for the behavior seen. The challenge to funding programs, such as the National Science Foundation's Minority Graduate Fellowship Program and the loss of programs such as the Department of Education's Patricia Roberts Harris Program[15] may lead minority students to doubt the availability of financial support for further graduate education.

(C) Selectivity Plus Shrinkage

Over the period 1994-1997, we noted a decrease in the size of the entering S&E graduate student population overall. The decline in entering graduate enrollment occurred across all fields of science and engineering with a more dramatic decline between 1996 and 1997. For example, the all fields decline was:

- 2.0% between 1994-1995
- 1.5% between 1995-1996, and
- 9.3% between 1996-1997.

The NSCSM&E fields decline was:

- 0.7% between 1994-1995
- 2.3% between 1995 -1996, and
- 7.8 % between 1996-1997.

It is not clear whether this reflects a loss of students choosing graduate education or a deliberate "downsizing" of the graduate enterprise. Many of the students with whom we spoke had a limited perspective on employment options for Ph.D.'s. Most knew faculty positions were scarce but were still committed to pursuit of advanced degrees. *Science and Engineering Indicators—1998* reports a gradual decline in foreign graduate student S&E enrollments (which would not be reflected in our overall numbers for U.S. citizens and permanent residents). Data available through 1996 indicate a continuing drop for this foreign group, which, coupled with the decline in the enrollment of U.S. citizens and permanent residents portends a continuation of the trend toward shrinkage of S&E graduate education. Students electing to go into the job market would

[15] The Patricia Roberts Harris Fellowship Program is part of the Higher Education Act (HEA) of 1965, Title IX, Part B, as amended by Public Law 103-208 (20 U.S.C. 1134d-1134g). Designed to provide grants for master's level, professional, and doctoral study to women and individuals from minority groups who are underrepresented in such programs, and who demonstrate financial need, this program expired September 30, 1997. As of this printing, H.R. 6, a bill to reauthorize HEA will be in conference in September, 1998.

cause an enrollment downturn as would deliberate downsizing of the R&D enterprise at these institutions. The latter possibility might be reflective of concern about the amount of R&D funding within the federal budget (AAAS, 1998).

Such downsizing might be a response to real or anticipated declines in available research (and research assistance) resources. Were such funding decreases occurring (or being anticipated), institutions might be hesitant to make obligations to students and/or might increase the level of selectivity of students to whom they do make commitments. For example, site visits to some of the most selective institutions in our survey revealed that some departments had re-introduced the use of the Graduate Record Examination (GRE) as a screen within the past several years.

While some institutions may have "felt poorer," the data do not support a shrinkage of federal support for research for most of the institutions in our survey (National Science Foundation, Academic Research and Development Expenditures: FY 1996).

Losing Ground

Increases in bachelor's degree production in S&E fields for Black and Hispanic Americans would lead us to expect increased enrollment in S&E graduate programs. Not only do we not see an increase for first-time graduate S&E enrollees, but rather, we see a precipitous drop, for African American and Hispanic American students. Survey data document the abrupt decline between 1996 and 1997, and the authors have proposed several hypotheses that might explain these results.

We cannot dismiss the possibility that Black and Hispanic American students made a positive choice to enter a thriving job market. But the timing and magnitude of the drop also suggests the interaction with contextual factors leading to a loss of these students from consideration of S&E graduate enrollment. These may include public discourse, legislative actions, judicial rulings and declining targeted financial support that arose in the wake of the *Adarand* decision, Regent's ruling, Proposition 209, and the *Hopwood* ruling.

Higher education has not been insulated from the fallout associated with *Adarand*. As we visited campuses, the lack of clear guidance related to the "targeting" of graduate student financial support, graduate programs and efforts arose as an issue.

Several other contextual factors such as the decentralized nature of graduate school education, the structure of faculty rewards and incentives, and the mechanisms of financial support associated with research grants came into play.

Getting minority students to and through graduate education in S&E is already a fragile process. The uncertainties being introduced by the often bitter discussions regarding affirmative action and the fallback positions of universities regarding financial aid are making it an even more fragile process. Common themes emerged from our meetings with faculty, administrators, and graduate students that helped illuminate the attitudes and behaviors that shape the choices leading to the quantitative results described earlier. Some of the factors that emerged from our site visits to the ten select institutions are described below.

Students' Perspectives

- Minority students were drawn by the same opportunities that drew others—to be part of a community of scholars—but they must cope with the cultural isolation (from scholarly and minority communities) that often accompanies that decision.
- Students have made the specific choice to pursue graduate education and not seek employment. Minority students, like all students, are applying to a large number of the same "tier" of selective institutions.
- Minority students noted the large number of foreign students and suggested their sense of the faculty's preference for these students. Our site visits confirmed that there is often more aggressive outreach for foreign students than for underrepresented minority students.
- The steady increase of foreign students among Ph.D. recipients has likely occurred through a confluence reflecting a large supply of such students with "pent up" demand for education, change in the political landscape of some countries (e.g. China), weaker demand for graduate education by American students, and strong demand for graduate students by research universities.
- Underrepresented minority students speak of not being invited, encouraged, or directed to graduate education. They noted professors' surprise at seeing them in classes as well as the surprise of white students and the assumption that they were likely admitted as an "exception."
- Sometimes the influence of a mentor helped provide motivation and context for the students' choice of graduate education. One Latina enrolled in a Ph.D. program in molecular biology talked about the minority faculty member whose mentorship had led her toward graduate education. While her background (first-generation college from a large family) might have suggested that she would have been better able to explain the choice of medicine or have been more in need of immediate employment, her professor, drawing on his own experiences, saw a different future for her, one which she has embraced.

Faculty and Administrators' Perspectives

- There was a sense among administrators and faculty that federal policies must remain in place and that institutions needed to be continuously challenged on diversity. Students—as well as minority outreach staff—expressed a sense that only federal requirements for diversity in supported programs were holding any sway over the makeup of the graduate student population. While California's rulemaking around the Regents resolution included an exception to allow acceptance of targeted federal funding, higher education institutions in other states pointed out that the hostile climate created by Proposition 209 allowed them to attract highly talented students away from University of California institutions.
- Due to the decentralization of graduate schools within higher education institutions, the majority of the student selection occurs in the individual S&E departments, not in the graduate school.
- Individual faculty bring their personal value systems to their selection of graduate students with whom they work. Labs comprised of women faculty often have large numbers of female students. Asian faculty often have labs filled with large numbers of Asian students. Underrepresented minority faculty often attract students from underrepresented groups.
- Departments with powerful minority and female faculty (as Principal Investigators of large research grants, full professors or department chairs) tend to have student diversity.

- Most elite institutions are used to selecting from among the best students who seek them out rather than having to seek out students.
- Most institutions are accustomed to using traditional measures of quality (e.g., GRE scores). Some students acknowledged that while some students may not be as well-prepared as others in terms of traditional measures, this does not mean they lack the potential to be a good scientist or engineer.
- Faculty are drawn to the work ethic of many of the foreign students who are often willing to work hard (in some cases, excessively long hours) for very little funding.
- Students most able to immediately assist faculty are more likely to be offered support, such as through research assistantships. The strength of the application (using measures such as the GRE and GPA) is factored into decisions by faculty to offer support.

The findings from this study suggest that a coherent, coordinated response is needed that addresses both the structural barriers inherent in the current system of graduate education and the specific barriers to African American, Hispanic American and American Indian students. The need for a continual flow of the talented students into science and engineering is a national need—one that requires a national and nationwide response one institution at a time.

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Appendix I

Alfred P. Sloan Foundation Survey

AAAS/Alfred P. Sloan Foundation-funded Survey

Purpose:

To study the current and recent changes in policies and practices of research universities with respect to graduate admission and graduate financial aid for underrepresented minorities (African Americans, Hispanics, and American Indians) seeking to pursue science and engineering (S&E) PhDs in research universities. The information you provide in this survey will be considered confidential and WILL NOT be used to directly compare the programs and services at individual institutions. While your university will be listed as a survey respondent, your university name will not be associated with your data. Rather, information gathered from all institutions will be compiled, analyzed and presented in a report to the Alfred P. Sloan Foundation.

Please complete and return survey no later than November 10, 1997.

Should you have any questions regarding this survey, please contact Ginny Van Horne at (202) 326-6631 or via e-mail at gvanhorn@aaas.org.

Instructions/Definitions:

In order to expedite survey completion, we are using the same broad categories as used by the Department of Education's Integrated Postsecondary Education Data System (IPEDS). The survey is separated into two parts. The first part consists of six data collection sheets. Each sheet represents an S&E field. (Please refer to the taxonomy on the following page.) Data on the number of applications received, offers of acceptances made, and number of first-time enrollments by individuals into S&E advanced degree (Master's and/or Doctoral) programs are requested. The second part of the survey consists of one page of questions pertaining to graduate student financial aid.

Applicant—a U.S. citizen or permanent resident who has submitted a formal application to an S&E advanced degree (Master's and/or Doctoral) program within the institution.

Admits—a U.S. citizen or permanent resident who has been offered acceptance by the institution into an S&E advanced degree (Master's and/or Doctoral) program.

Enrollee—a full-time or part-time student (U.S. citizen or permanent resident) entering an S&E advanced degree (Master's and/or Doctoral) program for the first-time. A student should be reported in only **one** department. Students enrolled in interdisciplinary/interinstitutional programs should be counted only once, by their "home" department.

Incomplete Data—please write "unavailable" in data cells as applicable. Data cells left blank are presumed to be zeroes.

Racial/Ethnic descriptions:

- **African American, Black, non-Hispanic**—a U.S. citizen or permanent resident having origins in any of the black racial groups of Africa (except those of Hispanic origin).
- **American Indian/Alaskan Native**—a U.S. citizen or permanent resident having origins in any of the original peoples of North America and who maintains cultural identification through tribal affiliation or community recognition.
- **Asian or Pacific Islander**—a U.S. citizen or permanent resident having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or Pacific Islands. This includes people from China, Japan, Korea, the Philippine Islands, American Samoa, India, and Vietnam.
- **Hispanic**—a U.S. citizen or permanent resident of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race.
- **White, non-Hispanic**—a U.S. citizen or permanent resident having origins in any of the original peoples of Europe, North Africa or the Middle East (except those of Hispanic origin).
- **Other/Unknown**—this category is used only if the individual did not select a racial/ethnic designation or if the individual indicated the other/unknown category.

TAXONOMY OF S&E FIELDS

Natural Sciences—include the following:

Physical sciences (chemistry, astronomy, physics)
Environmental sciences (earth, atmospheric, and ocean sciences, including geophysics, seismology, and meteorology)
Life sciences (biological, agricultural, and medical PhD. (Report MD, DO, DVM, or DDS candidates **only** if they are concurrently working for an S&E Master's or PhD.)

Mathematics—include the following:

Mathematics
Actuarial sciences
Applied mathematics
Pure mathematics
Statistics
Other mathematics

Computer Science—include the following:

Computer and information sciences
Computer programming
Data processing
Information sciences and systems
Systems analysis
Microcomputer analysis
Other computer and information sciences

Engineering—include the following:

Aeronautical/Astronautical
Chemical
Civil
Electrical
Industrial
Mechanical
Materials/Metallurgical
Other engineering

Social Sciences—include the following:

Agricultural economics
Anthropology
Economics
Geography
Linguistics
Political sciences
Sociology
Other social sciences

Psychology—include the following:

Psychology, general
Clinical
Cognitive
Community
Counseling
Developmental and Child
Experimental
Industrial and Organizational
Physiological
Social
Other psychology

This taxonomy may not correspond to those used in your institution. Therefore, please feel free to exercise your judgment. If this is the case, we would appreciate it if you could write down on a separate sheet how the taxonomy was used.

Financial Support
(This survey applies to U.S. citizens and permanent residents only.)

1. Does your institution offer financial support to science and engineering (S&E) graduate students targeted by race/ethnicity? ____Yes ____No. If no, did your institution previously offer race-based support? ___Yes ___No.

   If yes, please use the tables on the following pages to provide a breakdown of the total amount of graduate support provided to graduate students—separated by the broad S&E fields of Natural Sciences, Mathematics, Computer Science, Engineering, Social Sciences, and Psychology—for the years 1994-95, 1995-96, 1996-97, and 1997-98.

2. In light of the changing policy climate and debate on affirmative action within the country, has your institution moved to eliminate race as a consideration/factor in the awarding of graduate student support for S&E students in the past few years? ____Yes ____No

   If yes, has your institution developed other measures of disadvantage to consider in the awarding of graduate student support for S&E students? ____Yes ____No

   If yes, what measures of disadvantage does your institution take into consideration?

   ____ Applicant is from a disadvantaged urban or rural neighborhood.
   ____ Applicant attended an economically disadvantaged high school, Historically Black College/University or Minority Institution
   ____ Applicant has special circumstances and/or personal challenges (e.g., applicant is first person in his/her family to apply to an advanced degree program).
   ____ Other (please describe). _____

3. Can your institution provide us with disaggregated data (via race and gender within race) on financial support programs for advanced degree students? ____Yes ____No

4. If yes, can your institution tell us the percentage of underrepresented minorities that have a:

research assistantship	____Yes ____No
teaching assistantship	____Yes ____No
university fellowship	____Yes ____No
federal fellowship	____Yes ____No
fellowships from non-university sources	____Yes ____No
other financial support	____Yes ____No

   If yes, can data be provided by broad disciplinary category or by department? ____Yes ___No.

5. How are most of your underrepresented minorities being supported? Rank in order (from one to five, with five being the highest) the following:

   _____ state
   _____ federal
   _____ private
   _____ self-support
   _____ other sources (Please list examples) _____

6. Does your institution monitor the number of graduate students who drop out of S&E programs? ____Yes ____No

7. Does your institution monitor the number of underrepresented minority graduate students who drop out of S&E programs? ____Yes ____No

8. Do you conduct exit interviews of graduate students? ____Yes ____No

9. Does the institution collect data that would provide information as to why students leave S&E advanced degree programs? ____ Yes ____No

10 Does your institution accept portable fellowships that are race-based (e.g., the National Science Foundation Graduate Minority Fellowship)? ____Yes ____No

Name of person completing the survey:_____Title:_____

Natural Sciences*

AAAS Use Only Control Number: _____	Total Number of Students	Total—U.S. Citizens & Perm. Residents	Total Female (U.S. Citizens & Perm. Residents)	Total Underrepresented* Minorities (U.S. Citizens & Perm. Residents)		Disaggregated U.S. Citizens & Permanent Residents (if available) If possible, disaggregate by gender within race.											
				male	female	African American		Hispanic		American Indian or Alaskan Native		Asian or Pacific Islander		White		Other/ Unknown	
						M	F	M	F	M	F	M	F	M	F	M	F
Number of graduate student **applicants** to natural science graduate programs in 1994-95																	
Number of graduate student **applicants** to natural science graduate programs in 1995-96																	
Number of graduate student **applicants** to natural science graduate programs in 1996-97																	
Number of graduate student **applicants** to natural science graduate programs in 1997-98 (as of 11/1/97) *																	
Number of **admits** to natural science graduate programs in 1994-95																	
Number of **admits** to natural science graduate programs in 1995-96																	
Number of **admits** to natural science graduate programs in 1996-97																	
Number of **admits** to natural science graduate programs in 1997-98 (as of 11/1/97) *																	
First time (new) 1994-95 graduate student **enrollees** (full- and part-time) in the natural sciences																	
First time (new) 1995-96 graduate student **enrollees** (full- and part-time) in the natural sciences																	
First time (new) 1996-97 graduate student **enrollees** (full- and part-time) in the natural sciences																	
First time (new) 1997-98 graduate student **enrollees** (full- and part-time) in the natural sciences—please provide data available as of 11/1/97 *																	

*Natural Sciences include the physical sciences (chemistry, physics, astronomy), environmental sciences (earth, atmospheric, and oceanographic sciences, including geophysics, seismology, and meteorology), and the life sciences (biological, agricultural, and medical PhD—report MD, DO, DVM, or DDS candidates **only** if they are concurrently working for an S&E Master's or PhD or are enrolled in a joint MD/PhD program). Underrepresented minorities include African American, Hispanic, and American Indian graduate students who are either U.S. citizens or permanent residents.

Please indicate in this line if you reported preliminary figures or official figures for the school year 1997-98 _____

Name of Person Completing this Survey _____ Name of Institution _____ Phone # _____ E-mail _____

Please return this form to: Ginny Van Horne, American Association for the Advancement of Science, 1200 New York Ave., NW, Washington, DC 20005, (202) 326-6631, FAX (202) 371-9849, gvanhorn@aaas.org

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Computer Science*

AAAS Use Only Control Number: _____	Total Number of Students	Total—U.S. Citizens & Perm. Residents	Total Female (U.S. Citizens & Perm. Residents)	Total Underrepresented* Minorities (U.S. Citizens & Perm. Residents)		Disaggregated U.S. Citizens & Permanent Residents (if available) If possible, disaggregate by gender within race.											
				male	female	African American		Hispanic		American Indian or Alaskan Native		Asian or Pacific Islander		White		Other/ Unknown	
						M	F	M	F	M	F	M	F	M	F	M	F
Number of graduate student **applicants** to computer science graduate programs in 1994-95																	
Number of graduate student **applicants** to computer science graduate programs in 1995-96																	
Number of graduate student **applicants** to computer science graduate programs in 1996-97																	
Number of graduate student **applicants** to computer science graduate programs in 1997-98 (as of 11/1/97) *																	
Number of **admits** to computer science graduate programs in 1994-95																	
Number of **admits** to computer science graduate programs in 1995-96																	
Number of **admits** to computer science graduate programs in 1996-97																	
Number of **admits** to computer science graduate programs in 1997-98 (as of 11/1/97) *																	
First time (new) 1994-95 graduate student **enrollees** (full- and part-time) in the computer sciences																	
First time (new) 1995-96 graduate student **enrollees** (full- and part-time) in the computer sciences																	
First time (new) 1996-97 graduate student **enrollees** (full- and part-time) in the computer sciences																	
First time (new) 1997-98 graduate student **enrollees** (full- and part-time) in the computer sciences—please provide data available as of 11/1/97 *																	

*Computer Science includes computer and information sciences, computer programming, information sciences and systems, systems analysis, microcomputer analysis, and other computer and information sciences

Underrepresented minorities include African American, Hispanic, and American Indian graduate students who are either U.S. citizens or permanent residents.

Please indicate in this line if you reported preliminary figures or official figures for the school year 1997-98. _____

Name of Person Completing this Survey _____ Name of Institution _____ Phone # _____ E-mail _____

Please return this form to: Ginny Van Horne, American Association for the Advancement of Science, 1200 New York Ave., NW, Washington, DC 20005, (202) 326-6631, FAX (202) 371-9849, gvanhorn@aaas.org

Mathematics*

AAAS Use Only Control Number: _____	Total Number of Students	Total—U.S. Citizens & Perm. Residents	Total Female (U.S. Citizens & Perm. Residents)	Total Underrepresented* Minorities (U.S. Citizens & Perm. Residents)		Disaggregated U.S. Citizens & Permanent Residents (if available) If possible, disaggregate by gender within race.											
				male	female	African American		Hispanic		American Indian or Alaskan *Native*		Asian or Pacific Islander		White		Other/ Unknown	
						M	F	M	F	M	F	M	F	M	F	M	F
Number of graduate student **applicants** to mathematics graduate programs in 1994-95																	
Number of graduate student **applicants** to mathematics graduate programs in 1995-96																	
Number of graduate student **applicants** to mathematics graduate programs in 1996-97																	
Number of graduate student **applicants** to mathematics graduate programs in 1997-98 (as of 11/1/97) *																	
Number of **admits** to mathematics graduate programs in 1994-95																	
Number of **admits** to mathematics graduate programs in 1995-96																	
Number of **admits** to mathematics graduate programs in 1996-97																	
Number of **admits** to mathematics graduate programs in 1997-98 (as of 11/1/97) *																	
First time (new) 1994-95 graduate student **enrollees** (full- and part-time) in the mathematics																	
First time (new) 1995-96 graduate student **enrollees** (full- and part-time) in mathematics																	
First time (new) 1996-97 graduate student **enrollees** (full- and part-time) in mathematics																	
First time (new) 1997-98 graduate student **enrollees** (full- and part-time) in mathematics—please provide data available as of 11/1/97 *																	

*Mathematics includes mathematics, actuarial sciences, applied mathematics, pure mathematics, statistics, and other mathematics.

Underrepresented minorities include African American, Hispanic, and American Indian graduate students who are either U.S. citizens or permanent residents.

Please indicate in this line if you reported preliminary figures or official figures for the school year 1997-98 _____

Name of Person Completing this Survey _____ Name of Institution _____ Phone # _____ E-mail _____

Please return this form to: Ginny Van Horne, American Association for the Advancement of Science, 1200 New York Ave., NW, Washington, DC 20005, (202) 326-6631, FAX (202) 371-9849, gvanhorn@aaas.org

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Engineering *

AAAS Use Only Control Number: _____	Total Number of Students	Total—U.S. Citizens & Perm. Residents	Total Female (U.S. Citizens & Perm. Residents)	Total Underrepresented* Minorities (U.S. Citizens & Perm. Residents)		Disaggregated U.S. Citizens & Permanent Residents (if available) If possible, dissaggregate by gender within race.											
				male	female	African American		Hispanic		American Indian or Alaskan Native		Asian or Pacific Islander		White		Other/ Unknown	
						M	F	M	F	M	F	M	F	M	F	M	F
Number of graduate student **applicants** to engineering graduate programs in 1994-95																	
Number of graduate student **applicants** to engineering graduate programs in 1995-96																	
Number of graduate student **applicants** to engineering graduate programs in 1996-97																	
Number of graduate student **applicants** to engineering graduate programs in 1997-98 (as of 11/1/97) *																	
Number of **admits** to engineering graduate programs in 1994-95																	
Number of **admits** to engineering graduate programs in 1995-96																	
Number of **admits** to engineering graduate programs in 1996-97																	
Number of **admits** to engineering graduate programs in 1997-98 (as of 11/1/97) *																	
First time (new) 1994-95 graduate student **enrollees** (full- and part-time) in engineering																	
First time (new) 1995-96 graduate student **enrollees** (full- and part-time) in engineering																	
First time (new) 1996-97 graduate student **enrollees** (full- and part-time) in engineering																	
First time (new) 1997-98 graduate student **enrollees** (full- and part-time) in engineering—please provide data available as of 11/1/97 *																	

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*Engineering includes aeronautical/astronautical, chemical, civil, electrical, industrial, mechanical, materials/metallurgical, and other engineering.

Underrepresented minorities include African American, Hispanic, and American Indian graduate students who are either U.S. citizens or permanent residents.

Please indicate in this line if you reported preliminary figures or official figures for the school year 1997-98. _____

Name of Person Completing this Survey _____ Name of Institution _____ Phone # _____ E-mail _____

Please return this f[illegible]n to: Ginny Van Horne, American Association for the Advancement of Science, 1200 New York Ave., NW, Washington, DC 20005, (202) 326-6631, FAX (202) 371-9849, gvanhorn@aaas.org

Social Sciences*

AAAS Use Only Control Number: _____	Total Number of Students	Total—U.S. Citizens & Perm. Residents	Total Female (U.S. Citizens & Perm. Residents)	Total Underrepresented* Minorities (U.S. Citizens & Perm. Residents)		Disaggregated U.S. Citizens & Permanent Residents (if available) If possible, disaggregate by gender within race.											
				male	female	African American		Hispanic		American Indian or Alaskan Native		Asian or Pacific Islander		White		Other/ Unknown	
						M	F	M	F	M	F	M	F	M	F	M	F
Number of graduate student **applicants** to social science graduate programs in 1994-95																	
Number of graduate student **applicants** to social science graduate programs in 1995-96																	
Number of graduate student **applicants** to social science graduate programs in 1996-97																	
Number of graduate student **applicants** to social science graduate programs in 1997-98 (as of 11/1/97) *																	
Number of **admits** to social science graduate programs in 1994-95																	
Number of **admits** to social science graduate programs in 1995-96																	
Number of **admits** to social science graduate programs in 1996-97																	
Number of **admits** to social science graduate programs in 1997-98 (as of 11/1/97) *																	
First time (new) 1994-95 graduate student **enrollees** (full- and part-time) in the social sciences																	
First time (new) 1995-96 graduate student **enrollees** (full- and part-time) in the social sciences																	
First time (new) 1996-97 graduate student **enrollees** (full- and part-time) in the social sciences																	
First time (new) 1997-98 graduate student **enrollees** (full- and part-time) in the social sciences—please provide data available as of 11/1/97 *																	

*Social Sciences include agricultural economics, anthropology, economics, geography, linguistics, political sciences, sociology, and other social sciences.
Underrepresented minorities include African American, Hispanic, and American Indian graduate students who are either U.S. citizens or permanent residents.
Please indicate in this line if you reported preliminary figures or official figures for the school year 1997-98 _____

Name of Person Completing this Survey _____ Name of Institution _____ Phone # _____ E-mail _____

Please return this form to: Ginny Van Horne, American Association for the Advancement of Science, 1200 New York Ave., NW, Washington, DC 20005, (202) 326-6631, FAX (202) 371-9849, gvanhorn@aaas.org

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Psychology*

AAAS Use Only Control Number: _____	Total Number of Students	Total—U.S. Citizens & Perm. Residents	Total Female (U.S. Citizens & Perm. Residents)	Total Underrepresented* Minorities (U.S. Citizens & Perm. Residents)		Disaggregated U.S. Citizens & Permanent Residents (if available) If possible, disaggregate by gender within race.											
				male	female	African American		Hispanic		American Indian or Alaskan Native		Asian or Pacific Islander		White		Other/ Unknown	
						M	F	M	F	M	F	M	F	M	F	M	F
Number of graduate student **applicants** to psychology graduate programs in 1994-95																	
Number of graduate student **applicants** to psychology graduate programs in 1995-96																	
Number of graduate student **applicants** to psychology graduate programs in 1996-97																	
Number of graduate student **applicants** to psychology graduate programs in 1997-98 (as of 11/1/97) *																	
Number of **admits** to psychology graduate programs in 1994-95																	
Number of **admits** to psychology graduate programs in 1995-96																	
Number of **admits** to psychology graduate programs in 1996-97																	
Number of **admits** to psychology graduate programs in 1997-98 (as of 11/1/97) *																	
First time (new) 1994-95 graduate student **enrollees** (full- and part-time) in psychology																	
First time (new) 1995-96 graduate student **enrollees** (full- and part-time) in psychology																	
First time (new) 1996-97 graduate student **enrollees** (full- and part-time) in psychology																	
First time (new) 1997-98 graduate student **enrollees** (full- and part-time) in psychology—please provide data available as of 11/1/97 *																	

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*Psychology includes general, clinical, cognitive, community, counseling, developmental and child, experimental, industrial and organizational, physiological, social and other psychology.

Underrepresented minorities include African American, Hispanic, and American Indian graduate students who are either U.S. citizens or permanent residents.

Please indicate in this line if you reported preliminary figures or official figures for the school year 1997-98: _____

Name of Person Completing this Survey _____ Name of Institution _____ Phone # _____ E-mail _____

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Appendix II

Interview Protocols

Interview Protocols

Name of Interviewer_____Date_____

Name of Institutution_____

Name of Interviewee_____Title_____

Phone_____E-mail_____

Questions for Dean of Graduate School/Outreach Coordinators/Faculty:

1. What is the graduate school's policy with regard to the recruitment, enrollment, and education of underrepresented minority students into science and engineering (S&E) programs? Is this a formal policy? Could we get a copy of this policy?

2. Is there a specific person/department within the institution assigned to implement and monitor this policy? Are the S&E departments responsible for recruiting underrepresented minorities?

   If the S&E departments are responsible, what kinds of things do they do to recruit underrepresented minorities? [Probe: For example, do they have "feeder" relationships with the community? Businesses?]

   If an outreach person is responsible, how difficult is their job? [Probe: are you trying to live within the letter of the law? Are you trying to recruit diverse students even though the institution prohibits using race and gender as outreach?]

   Are some S&E departments "better" at recruiting underrepresented minorities than others? Why?

   What would make a difference in building faculty involvement in the education of a diverse student population? [Probe: Money? Better and more specific policies on research and training grants?]

3. Please provide some examples of what your institution is doing with respect to this effort. [Probe: For example, does the institution have specific activities or goals to recruit and retain underrepresented minorities into S&E? Does the institution offer summer S&E programs to get minority undergraduates interested in pursuing graduate school? Does the institution offer remedial programs targeted to specific groups? Are you affiliated with the GEM program? Do you have Ford Fellows?]

4. Does the institution offer incentives to faculty, staff, etc., to recruit underrepresented minorities into S&E programs and if so, what are they?

5. Does the institution monitor these students' progress/performance? Follow-up with them? Track their retention rates?

6. Does the institution allow for part-time matriculation in the science and engineering advanced degree programs?

7. To what extent does the institution foster relationships for underrepresented minorities with industry? For example, internships?

8. We imagine that there are a lot of informal connections for these students—finding mentors, minority students networking with each other, etc. Does the institution or department also provide formal mentors for these students and/or formal opportunities for networking with underrepresented minorities or is it up to the student to make these connections?

9. If an underrepresented minority student wanted to provide feedback to the graduate school, how might he or she go about it? What channels of communication are there for feedback from underrepresented minorities to the graduate school?

10. What do you feel are the institution's major strengths in its present activities and programs for underrepresented minorities? Weaknesses?

11. What are the institution's future plans with regard to these efforts? Any changes?

12. Are there obstacles which hamper the institution's efforts or desired future efforts? What are these obstacles?

13. What do you see as your greatest challenge? [Probe: change in attitude of faculty?]

Financial Aid

1. Are there special funds allocated solely for financial aid to minority students? [Probe: Is there a small or relatively large proportion of funds available to these students?] How many students receive graduate support?

2. What is the source of these funds?

3. Where are these funds administered? By the graduate school? By the individual departments? By a minority affairs office?

4. To what extent is financial need considered in the awarding of this funding? What measures of disadvantage are taken into consideration?

5. What is the average nine-month [12 month] student expense budget for graduate students at your institution? [Room and board? Books and supplies? Living Expenses? Transportation? Fees? Tuition?]

Students

Ask each student to state their name, their year, their major, and their undergraduate school.

1. How do you like the S&E advanced degree program?

2. What type of support (financial, mentor, network, etc.) are you receiving?

3. Why did you opt to attend this institution? Were you recruited? By whom?

4. Did you apply to other institutions? Which ones?

5. Have you been involved in any types of special programs for minorities? For example, the Resource Center for Science and Engineering in Puerto Rico? GEM? The Meyerhoff program at UMBC?

6. Were you mentored as undergrads? Were you in summer programs?

7. Did you receive encouragement to attend grad school?

8. Would you recommend this university to others?

9. With what racial/ethnic group would you say you are affiliated?

Appendix III

Institutions Surveyed

AAAS/Alfred P. Sloan Foundation Funded Survey
U.S. Higher Education Institutions Surveyed
(*denotes those institutions which chose to participate in the study)

*Arizona State University

Auburn University

*Baylor College of Medicine

*Boston University

*California Institute of Technology

*Carnegie-Mellon University

Case Western Reserve University

*Clemson University

*Colorado State University

Columbia University

*Cornell University

*Duke University

*Emory University

*Florida State University

Georgia Institute of Technology

*George Washington University

*Georgetown University

*Harvard University

*Howard University

Indiana University

*Iowa State University

*Johns Hopkins University

*Louisiana State University

*Massachusetts Institute of Technology

*Michigan State University

*New Mexico State University

*New York University

*North Carolina State University at Raleigh

*Northwestern University

*Ohio State University

Oklahoma State University

*Oregon State University

Penn State University

*Princeton University

*Purdue University

*Rutgers—The State University of New Jersey

*Stanford University

*State University of New York at Buffalo

*State University of New York at Stony Brook

*Texas A&M University

*Tufts University

*Tulane University

*University of Alabama at Birmingham

*University of Arizona

*University of California, Berkeley

*University of California, Davis

*University of California, Irvine

*University of California, Los Angeles

*University of California, San Diego

*University of California, Santa Barbara

*University of California, San Francisco

University of Chicago

*University of Cincinnati

University of Colorado at Boulder

*University of Colorado at Denver

University of Connecticut

*University of Florida

*University of Georgia

*University of Hawaii at Manoa

*University of Illinois at Chicago

*University of Illinois at Urbana

*University of Iowa

*University of Kansas

*University of Kentucky

University of Maryland, College Park

*University of Miami

University of Michigan

*University of Minnesota

*University of Missouri

*University of Nebraska-Lincoln

*University of New Mexico

*University of North Carolina at Chapel Hill

*University of Oklahoma

*University of Pennsylvania

*University of Pittsburgh

*University of Rochester

*University of South Carolina

*University of South Florida

*University of Southern California

*University of Texas at Austin

*University of Utah

*University of Virginia

*University of Washington

*University of Wisconsin, Madison

Utah State University

*Vanderbilt University

*Virginia Commonwealth University

*Virginia Polytechnic Institute & State University

Washington State University

*Washington University in St. Louis

Wayne State University

*Yale University

Yeshiva University

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE
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With funding from the Alfred P. Sloan Foundation